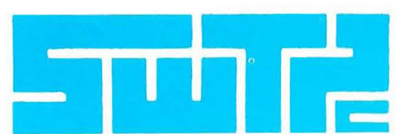

MAY 1980
Volume 5, Number 5
$2.50 in USA/$2.95 in Canada
BYTE®
the small systems journal
A McGRAW-HILL PUBLICATION
FLOPPY DISKS
ROBERT
TINNEY

Think BIG

State of the art "Winchester"type hard disk with a data storage capacity of nearly 16 Megabytes, makes the SWTPC 6809 system the most flexible as well as the most powerful eight-bit microcomputer system in the world. The intelligent controller, using DMA data transfer, makes maximum use of the "Winchester" capability. It is completely compatible with the FLEX9 operating system used on the SWTPC 6809 floppy disk system.

CDS-1 "Winchester" disk drive with controller . .$3,995.00
Cabinet—matching our 6809 computer desk . . . $150.00



SOUTHWEST TECHNICAL PRODUCTS CORPORATION
219 W. RHAPSODY
SAN ANTONIO, TEXAS 78216 **(512) 344-0241**

Circle 325 on inquiry card.



Low-cost hard disk computers are here and field proven

11 megabytes of hard disk and 64 kilobytes of fast RAM in a Z80A computer for under $10K. Two floppy drives, too. Naturally, it's from Cromemco.

It's a reality. In Cromemco's new Model Z-2H you get all of the above and even more. With Cromemco you get it all.

In this new Model Z-2H you get not only a large-storage Winchester hard disk drive but also two floppy disk drives. In the hard disk drive you get unprecedented storage capacity at this price—11 megabytes unformatted.

You get speed—both in the 4 MHz Z80A microprocessor and in the fast 64K RAM which has a chip access time of only 150 nanoseconds. You get speed in the computer minimum instruction execution time of 1 microsecond. You get speed in the hard disk transfer rate of 5.6 megabits/sec.

EXPANDABILITY

You get expandability, too. The high-speed RAM can be expanded to 512 kilobytes if you wish.

And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

BROADEST SOFTWARE SUPPORT

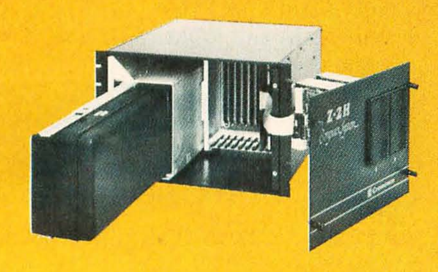
With the Z-2H you also get the broadest software support in the microcomputer field. Software Cromemco is known for. Software like this:

- **Extended BASIC**
- **FORTRAN IV**
- **RATFOR (RATional FORtran)**
- **COBOL**
- **Z80 Macro Assembler**
- **Word Processing System**
- **Data Base Management**

with more coming all the time.

SMALL, RUGGED, RELIABLE

With all its features the new Z-2H, including its hard disk drive, is still housed in just one compact cabinet.



Hard disk drive at lower left can be interchanged just by sliding out and disconnecting plug. Seven free card slots are available. Z-2H includes printer interface card.

Included in that cabinet, too, is Cromemco ruggedness and reliability. Cromemco is time-proved. Our equipment is a survey winner for reliability. Of course, there's Cromemco's all-metal cabinet. Rugged, solid. And, there's the heavy-duty power supply (30A @ 8V, 15A @ +18 V, and 15A @ −18V) for circuitry you'll sooner or later want to plug into those free card slots.

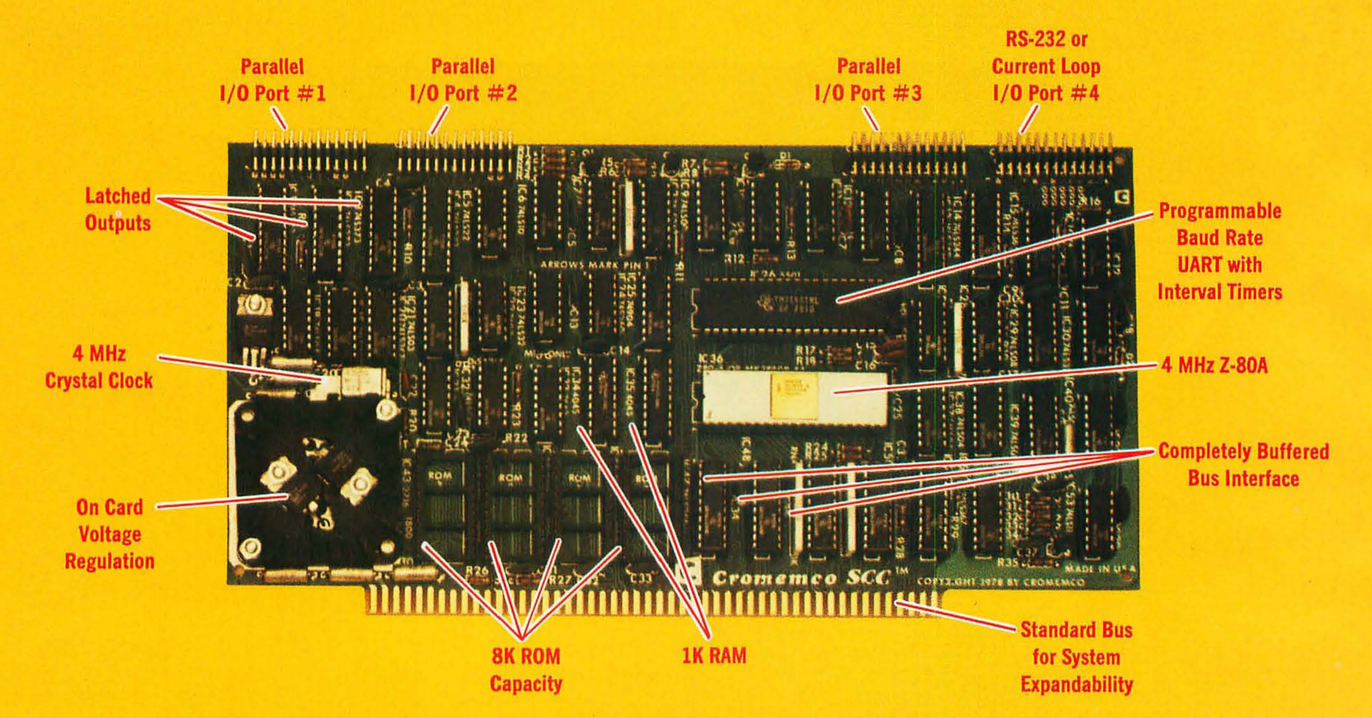
SEE IT NOW

Last summer we told you this new Z-2H would be a smash. And it is. So see it at your dealer's now. Have him put you in touch with a user—there are lots of them because Cromemco has been delivering for months. See for yourself how pleased our users are.

PRESENT CROMEMCO USERS
We've kept you in mind, too. Ask about the new Model HDD Disk Drive which can combine with your present Cromemco computer to give you up to 22 megabytes of disk storage.



Circle 1 on inquiry card.



The single card computer with the features that help you in real life

COMPLETE COMPUTER

In this advanced card you get a professional quality computer that meets today's engineering needs. And it's one that's complete. It lets you be up and running fast. All you need is a power supply and your ROM software.

The computer itself is super. Fast 4 MHz operation. Capacity for 8K bytes of ROM (uses 2716 PROMs which **can be programmed by our new 32K** BYTESAVER® PROM card). There's also 1K of on-board static RAM. Further, you get straightforward interfacing through an RS-232 serial interface with ultra-fast speed of up to 76,800 baud — software programmable.

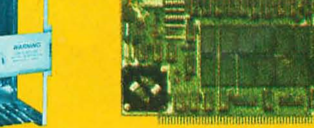
Other features include 24 bits of bidirectional parallel I/O and five onboard programmable timers.

Add to that vectored interrupts.

ENORMOUS EXPANDABILITY

Besides all these features the Cromemco single card computer gives you enormous expandability if you ever need it. And it's easy to expand. First, you can expand with the new Cromemco 32K BYTESAVER PROM card mentioned above. Then there's Cromemco's broad line of S100-bus-compatible memory and I/O interface cards. Cards with features such as relay interface, analog interface, graphics interface, optoisolator input, and A/D and D/A conversion. RAM and ROM cards, too.


Card Cage


32K BYTESAVER PROM card

EASY TO USE

Another convenience that makes the Model SCC computer easy to use is our Z-80 monitor and 3K Control BASIC (in two ROMs). With this optional software you're ready to go. The monitor gives you 12 commands. The BASIC, with 36 commands/functions, will directly access I/O ports and memory locations — and call machine language subroutines.

Finally, to simplify things to the ultimate, we even have convenient card cages. Rugged card cages. They hold cards firmly. No jiggling out of sockets.

AVAILABLE NOW/LOW PRICE

The Model SCC is available now at a low price of only $450 burned-in and tested (32K BYTESAVER only $295).

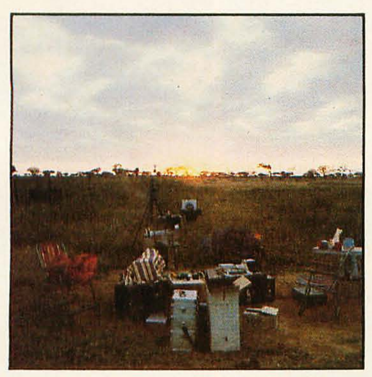
So act today. Get this high-capability computer working for you right away.



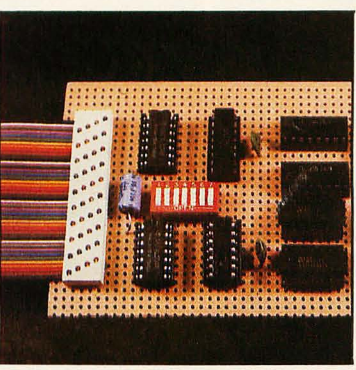
Circle 1 on inquiry card.

In The Queue

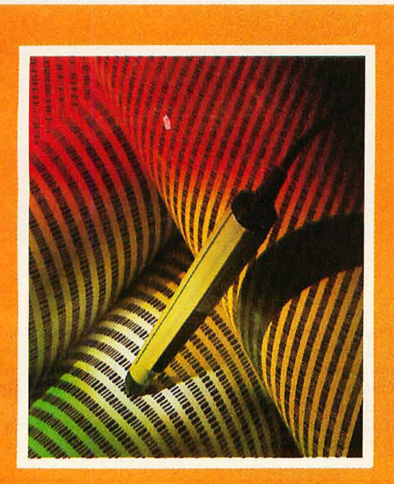
BYTE May 1980
Volume 5, Number 5



page 6



page 22



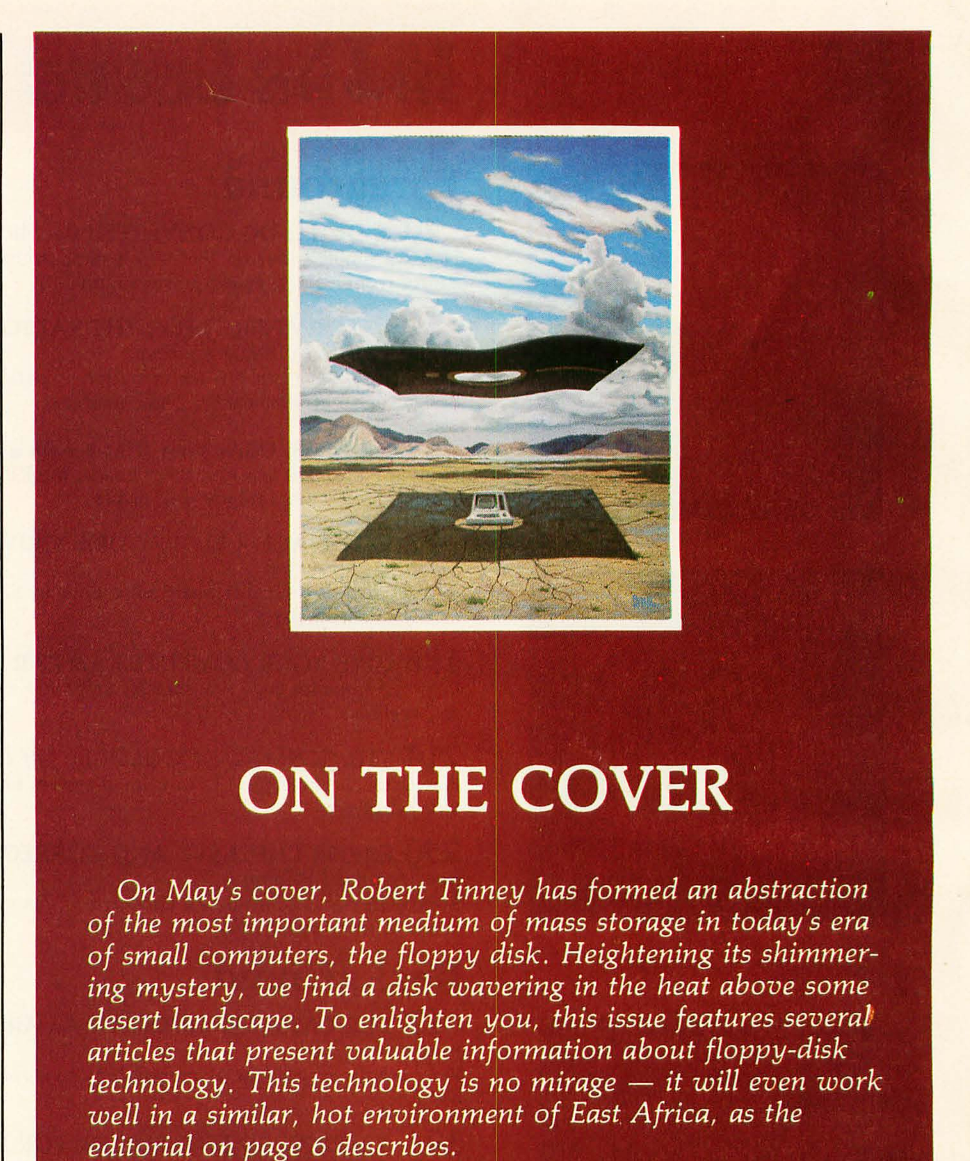
ON LAST MONTH'S COVER

The April cover, which has received so many compliments, was a creation of the photographic artistry of Ed Crabtree. Ed is a professional commercial photographer in Peterborough, N H and has been BYTE's photographer from day one. This was Ed's first BYTE cover. We're sure it won't be his last.

Foreground

Background

Nucleus



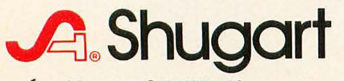
ON THE COVER

On May's cover, Robert Tinney has formed an abstraction of the most important medium of mass storage in today's era of small computers, the floppy disk. Heightening its shimmering mystery, we find a disk wavering in the heat above some desert landscape. To enlighten you, this issue features several articles that present valuable information about floppy-disk technology. This technology is no mirage — it will even work well in a similar, hot environment of East Africa, as the editorial on page 6 describes.

BYTE is published monthly by BYTE Publications Inc, 70 Main St, Peterborough NH 03458, a wholly-owned subsidiary of McGraw-Hill, Inc. Address all mail except subscriptions to above address: phone (603) 924-9281. Address subscriptions, change of address, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, PO Box 590, Martinsville NJ 08836. Controlled circulation postage paid at Waseca, Minnesota 56093 - USPS Publication No. 528890 (ISSN 0360-5280). Canadian second class registration number 9321. Subscriptions are $18 for one year, $32 for two years, and $46 for three years in the USA and its possessions. In Canada and Mexico, $20 for one year, $36 for two years, $52 for three years. $32 for one year air delivery to Europe. $32 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is $2.50 in the USA and its possessions, $2.95 in Canada and Mexico, $4.00 in Europe, and $4.50 elsewhere. Foreign subscriptions and sales should be remitted in United States funds drawn on a US bank. Printed in United States of America.
Address all editorial correspondence to the editor at the above address. Unacceptable manuscripts will be returned if accompanied by sufficient first class postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE.
BYTE® is available in microform from University Microfilms International, 300 N Zeeb Rd, Dept PR, Ann Arbor MI 48106 USA or 18 Bedford Row, Dept PR, London WC1R 4EJ ENGLAND.

AUDITED PAID CIRCULATION ABC

Subscription WATS Line: (800) 258-5485
Office hours: Mon-Thur 8:30 AM - 4:30 PM, Friday 8:30 AM - Noon, Eastern Time



Editorial

Computer-Controlled Viewing of the 1980 Eclipse

by Carl Helmers

As noted in the March 1980 editorial, I traveled to Kenya in East Africa to observe the 1980 total solar eclipse with an Apple II Pascal system controlling the photographing of the event. This month's editorial is a commentary about the experience. This commentary was written upon my return to New Hampshire a week after the eclipse.

The final prepations for the Kenya eclipse of 1980 were made in an intensive session of 24-hour workdays, February 2, 3, 4, and 5. One physiological consequence of no sleep for 3 or 4 days is that when traveling through 8 time zones there is no possibility for jet lag! One's body is so tired that all memory of the previous time zone is erased completely. Norm Whyte and Laurel Allen, who coordinated many of the details of the trip to Kenya, arrived in Boston from California on the second of February and spent the weekend at my home. During this final weekend's activity, we each had several chores to finish. One detail, for example, was making sure that both computers would operate simultaneously off Norm's portable Honda AC generator. Another was adding a hardwood extension to Norm's telescope mount so that my camera could be attached along with his.

In connection with the program design of my experiment, a number of crucial points had to be verified. With the time allocation procedures completed as described in the March 1980 editorial, writing the real-time procedures to execute the time line proved trivial. These were the procedures left in dummy form in the listing 1 published with the March 1980 editorial. In listing 1 accompanying this editorial, readers will find the final form of the program I used. In approaching this final form I implemented the execution routines using a module named "milli" to carry out time delays of an integer number of milliseconds. The program itself was verified by driving the camera interface using a first approximation to "milli" in the form of Pascal dummy loops used to count time.

Originally I hoped that (by fortuitous circumstance) I could use some combination of Pascal statements in a loop to provide time delays in units of milliseconds. But, after perhaps an hour of fooling with various combinations, I came to the conclusion that this would not be possible. I was either 6% too slow or 6% too fast depending on whether or not I put a unary negation in a timing loop's dummy assignment statement.

Since program development time was limited by a departure schedule, it soon became apparent that the lesser of two evils (imprecision or assembly language) was to write an assembly-language routine called "milli" that links to Pascal with a single integer parameter specifying a loop delay time in milliseconds. I finished this necessary step sometime in the wee hours of February 4. I checked the accuracy with various simple test programs written in Pascal. Of course, my timing assumption was that zero time would be spent outside of "milli" executing the Pascal code of the actual program. This assumption was verified with test runs of the whole eclipse photography sequence, which showed about 1% error. By adjusting the constants in the delay routine slightly, this error was compensated at the gross level of the entire eclipse sequence's 241-second execution time.

Text continued on page 52

"My Shugart followed me home."

"After working all day with the computer at work, it's a kick to get down to Basic at home. And one thing that makes it more fun is my Shugart minifloppy™. We use Shugart drives at work, so when I bought my own system I made sure it had a minifloppy drive.

"Why? Shugart invented the minifloppy. The guys who designed our system at work tell me that Shugart is the leader in floppy design and has more drives in use than any other manufacturer. If Shugart drives are reliable enough for hard-working business computers, they've got to be a good value for my home system.

"When I'm working on my programs late at night, I can't wait for cassette storage. My minifloppy gives me fast random access and data transfer. The little minidiskettes™ store plenty of data and file easily too.

"I made the right decision when I bought a system with the minifloppy. When you lay out your own hard-earned cash, you want reliability and performance. Do what I did. Get a system with the minifloppy."

If it isn't Shugart, it isn't minifloppy.



435 Oakmead Parkway, Sunnyvale, California 94086

See opposite page for list of manufacturers featuring Shugart's minifloppy in their systems.

TM minifloppy is a registered trademark of Shugart Associates

Information on Potter Printer Needed

Can a reader of BYTE help me? I recently purchased a printer from salvage, and I hoped to obtain documentation and a schematic diagram from the manufacturer.

The printer is a Potter Model LP-3000, manufactured by the Potter Instrument Company, formerly of Plainville, New York. I called the firm, and I was told:

1) The company is in the process of moving to New Hampshire.
2) This particular model of printer is obsolete.
3) They have no documentation or schematic for this model.

From my examination of the circuits and machinery, I believe the Potter LP-3000 is a daisy-wheel type with a serial data input. However, whether it uses ASCII or not, I can't tell.

Can someone tell me how I can interface this printer to my Radio Shack TRS-80 Model I Level II computer with expansion interface?

Nick Tountas
838 Juniper Rd
Glenview IL 60025

Questioning "Affordable"!

When you are on Social Security, an affordable computer system that costs $6000 is like "# @ * "! When your monthly income is $360, to have an editor smugly talk of plunking down $6000 cash as if it were a minor outlay tends to be *very* irritating.

On top of that, the system Mr Helmers described is just the sort (with minor modifications) I have wanted for ages. Another thing that hurts is the industry-wide disinclination to even consider time payments or credit. I know that I'll have to wait, and probably wait over 5 years, but maybe not. If I were just disgusted with your editorial, I wouldn't have bothered to write. What I would like to know is if any BYTE reader knows of a way I can obtain such a system as Mr Helmers described — perhaps secondhand — without paying thousands of dollars cash? By squeezing, I can afford $100 a month now, and by July I should be able to afford $150 a month, perhaps more.

In a way, I have to thank Mr Helmers for that editorial. It made me mad enough to write, and perhaps there is a solution to my problem.

Fred J Remus Jr
POB 2453
San Diego CA 92112

Carl Helmers Replies

Give the industry time. Five years ago, the same system might have been well in excess of $30,000, with inferior programming languages and comparable on-line storage capacity. Tremendous strides have been made in the past 5 years, and we can expect a certain leveling-off of prices in the future as mass production at 100,000 unit levels per year starts becoming reality. And then, of course, one looks at it from the point of view of increasing demand for these products. If we do not write about the conception of a good machine, we have no interest on the part of users.... **CH**

Gomoku

I was interested in the "Programming Quickie" by John Allwork ("BASIC Game: GOBANG," November 1979 BYTE, page 56) for Gobang is also called "Gomoku." There has been a competition running for Gomoku programs since 1975; I am the current champion. People interested in the contest should contact:

Shem Wang
Dept of Computer and Information Science
University of Guelph
Guelph, Ontario, CANADA

So far my different programs have run on large mainframe computers, but I hope to have one working on my North Star microcomputer for the next round of competition.

Mike Compton
196 Metcalfe St, Apt 810
Ottawa, Ontario
K2P 1P8 CANADA

Circle 2 on inquiry card.

Searching for FORTRAN Compiler

I am an avid reader of BYTE and I believe that one of my fellow readers may be able to help me with a problem.

My school is thinking about expanding the courses that are offered in the area of computer science. It is hoped that an extensive course in FORTRAN programming may be offered.

Our computer is a CIP/2200 manufactured by the Cincinnati Milacron Corporation. It has a small disk-operating system and a card reader. The word size is 32 bits, and, at this point in time, the memory size is 32 K bytes. There are plans, however, to expand the memory to 64 K bytes by the time the FORTRAN course is offered.

My problem is that the Cincinnati Milacron Corporation does not make a FORTRAN compiler for our machine. I would like to know if any reader of BYTE could suggest any companies that might sell a compiler that is compatible with our machine.

Daniell B McCormick
Box 675
Presbyterian College
Clinton SC 29325

Seeking Computers for the Blind

Does any reader of BYTE know of a source for a computer system that uses audible output instead of characters displayed on a terminal for its customary interaction with the user, such as that produced by the Votrax speech interface? Such a computer system would be used by blind people. It would be desirable if a BASIC interpreter that used audible output were included.

If anyone has or knows of such a system, please contact me.

Walter F Keleher
56 Robin St
Rochester NY 14613

Altair BASIC Patch Needed

I wonder if any BYTE readers could assist me in locating the patch to Altair 8 K 4.0 Version and Altair Extended 4.0 Version BASICs which will allow these BASICs to run on a Z80.

I recently purchased a TDL ZPU which uses the Z80. The manual notes this incompatibility stating that Altair BASIC "has as part of its routines several occasions where the parity flag is checked as part of the function. In the Z80 the parity flag indicates OVERFLOW during math routines, not parity." The manual states that it contains a patch in Appendix C, but no Appendix C is included.

If any reader of BYTE knows where this patch may be obtained, please let me know.

Hugh Morgan
7725 Berkshire Blvd
Powell TN 37849

Pascal Examples Needed

Just a short note to tell you how very much I appreciated Carl Helmers' "Pascal Checkbook Balancing Program" which appeared in the January 1980 BYTE.

As a beginner, I don't think he "*profaned* Pascal by writing a simple little ..." etc. The program was *most informative*, and I studied it in detail. I have adapted it to the formulation of a metrics conversion program. It was certainly clearer than most of the program examples in the few, but confusing, texts on Pascal.

I realize that in general BYTE magazine caters to the experienced programmer, but what we need are more examples like yours—the we being those of us relatively new to the art.

So thank you once again—and *please* some more tutorials and programs!

Max Nareff
5235 Diamond Heights Blvd
San Francisco CA 94131

A Satisfied Reader Comments

I couldn't believe it! Ted Carter's article "Implementing Dynamic Data Structures with BASIC Files" (February 1980 BYTE, page 92) was exactly what I needed for a program I am writing to computerize billing on a newspaper route.

I had tentatively planned my file routines, but I scrapped my ideas after reading the article.

James E Nichol
1416 Oak Knoll Dr
Cincinnati OH 45224 ■

Circle 3 on inquiry card. →

New from SSM.



80 Character Video

With 80 characters per line our VB3 is the perfect video interface for word processing. It produces a standard 80x24 display of upper and lower case characters or as much as 80x51 for a full page of text. The matrix for graphic display goes up to 160x204. And with optional EPROM, as many as 256 user programmed characters or symbols can be produced.

VB3 is memory mapped for rapid screen updating. But it occupies memory only when activated. So one or more VB3s can be located at the same address with a full 65K of memory still available to the user.

It generates both U.S. and European TV rates and meets the new IEEE S-100 standard. Other features include keyboard input, black on white or white on black, one level of grey, underline, strike thru, blinking char., blank-out char., and programmable cursor. Software includes a CP/M compatible driver and a powerful terminal simulator.

VB3 is available in several configurations. Retail prices start at $375 kit, $440 assembled.

Z-80 CPU

We spent over a year designing the CB2 to assure that it will be the most fully S-100 compatible Z-80 CPU on the market.

It operates at 2MHZ or 4MHZ by DIP switch selection and includes two sockets for 2716/2732 EPROMs or TMS 4016 2K RAMs. Memory sockets can be disabled. Separate run/stop and single step switches allow system evaluation without the benefit of a front panel.

CB2 also features an MWRITE signal, firmware vector jump, and an output port to control 8 extended address lines (allowing use of more than 65K of memory). Jumper options generate the new IEEE S-100 signals to insure future S-100 compatibility.

Retail price—$210 kit, $275, assembled.

Our line. CPU, Video, I/O, RAM, EPROM, EPROM Programmer, Music, Prototyping, Terminator, Extender, and Mother boards. Available assembled or as kits.

8080 CPU

Our new CB1A is identical to our popular CB1 with the exception that the on-board RAM has been increased from 256 bytes to a full 1K.

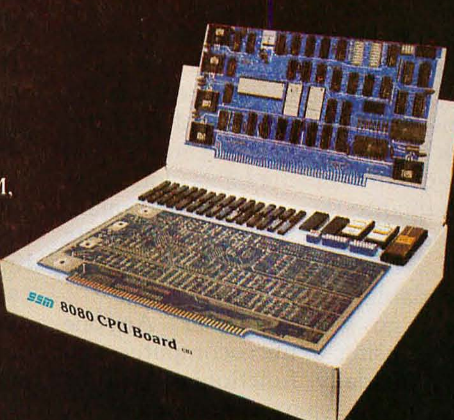
It also features an optional 2K of 2708 EPROMs, power-on/reset vector jump, MWRITE, parallel input port with status and DIP switch addressing.

Retail price—$159 kit, $219 assembled.



SSM Microcomputer Products
2190 Paragon Drive
San Jose, CA 95131 (408) 946-7400

Send for our free brochure and find out why SSM has become the favorite of discerning Hobbyists and OEMs.



The Cassette Lives On

An Alternative to Floppy-Disk Mass Storage

Emory Cook
Cook Laboratories Inc
375 Ely Ave
Norwalk CT 06854

In a world where floppy and hard disks are becoming more affordable for the average small-business user and hobbyist, sequential mass storage in the form of cassette tape is gaining disfavor. Still, many disk users get into trouble when something happens to a floppy disk and they have *not* made backup copies. Although any backup system requires the time and inconvenience of regularly carrying out the file-copying procedure, one problem with using floppy disks for file backup is the cumulative cost of the number of disks needed to maintain backup copies of all records.

The Cassette Solution

What is needed is a low-cost filing medium. Cassette storage is the answer, provided we take the necessary precautions to make it reliable. Old files, such as files of records for last quarter, last year, and the years before, *belong* on cassette. The disk-to-cassette transfer for backup purposes becomes sensible in terms of both expense and security. With adequate tape recorders and high-quality cassette tapes (which use both quality tape material and quality mechanical housings) cassette storage can and does become highly dependable.

Let's go a step further. Anyone who is using a microcomputer and needs its daily functioning will be acquiring a spare microprocessor. With a three-head, audio-cassette machine,which has a separate playback head following the record head (a common piece of high-fidelity equipment), the spare microprocessor can readily be set up with a machine-language program. This program verifies a backup tape by reading the information immediately as the tape is written. [*The same result can be accomplished (a bit slower, however) for those of us who cannot afford a spare microprocessor board or an expensive cassette recorder. This can be attained by using a verification program running on the same microprocessor to reread the newly created tape and compare its information with the contents of computer memory....*GW]

Floppy disks may be a glamorous way to store programs and data, but the cassette is far from dead.

When records are backed up at the end of some reasonable period (ie: day, week, month, etc), the extra time needed to dump the records to cassette at a low transfer rate is not an overwhelming disadvantage. A second backup tape simultaneously made with a second recorder is always a good idea. In other cases, one cassette copy can simply serve as a backup for printed records, thus saving time, printer wear, ribbons, and paper.

For even the most inexpensive cassette deck, a small amount of money and attention can result in the following:

- excellent performance and reliability (no more trial-and-error adjustment of the volume control)
- a very low error rate (statistically as good as that of a 5-inch floppy disk)
- the lowest possible cost per bit stored

Problems with Cassette Storage

The main problems with currently used cassette-storage methods are dirt, variation in tape speed, problems with azimuth alignment, and inferior tape quality.

Dirt collects on the tape recorder head from several sources, from the room, from dust left on poorly manufactured tapes, and sometimes from sweaty fingers attempting to wipe the head clean. The tape head and the pressure roller can be cleaned using pure alcohol and a cotton-tipped swab.

Periodic cleaning is imperative when using poorly manufactured tapes. Cassette tapes are manufactured by slitting a 30.5 cm(12-inch) wide sheet of magnetic material called a *web*. Slitting is accomplished with knives, which often get dull from cut-

Circle 4 on inquiry card. →

The best supported personal computer you can buy.

apple® computer

Call 800-538-9696, 800-662-9238 in California
or write: Apple Computer, 10260 Bandley Drive,
Cupertino, California 95014.

ting the inherently abrasive magnetic coating. If the knives are not periodically sharpened (which is the case in making some inexpensive cassettes), the dull knives cause a fine powder of magnetic coating to collect on the edges of the tape. As a result, abrasive magnetic powders come in contact with the tape head when the cassette is later played. The poorer the quality of the tape, the greater the chance that this is occurring.

Variation in tape speed can be caused by belts slipping within the cassette recorder, but it is more often caused by flaws in the pressure roller, which with the capstan is meant to push the tape through the machine at a constant speed. Leaving the tape recorder set in play mode with the motor disengaged (as is done in several current personal computer systems that let the computer control the tape motor) may eventually cause indentations on the pressure roller, with some inevitable variation in tape speed. This variation impairs the reliability and the data-transfer rate of the cassette interface, so it is important to keep the pressure roller clean at all times and disengaged when not in use.

Azimuth of the tape head refers to the angle between an imaginary line drawn in the direction of tape movement and the vertical, magnetic gap on the record/playback head of the cassette recorder. This angle should be 90°–that is, the tape should run straight across the tape head, perpendicular to the magnetic gap. If the tape head is somehow knocked out of alignment (which happens frequently, although nobody knows how), it must be restored if the tape recorder is to faithfully play back a recorded tape.

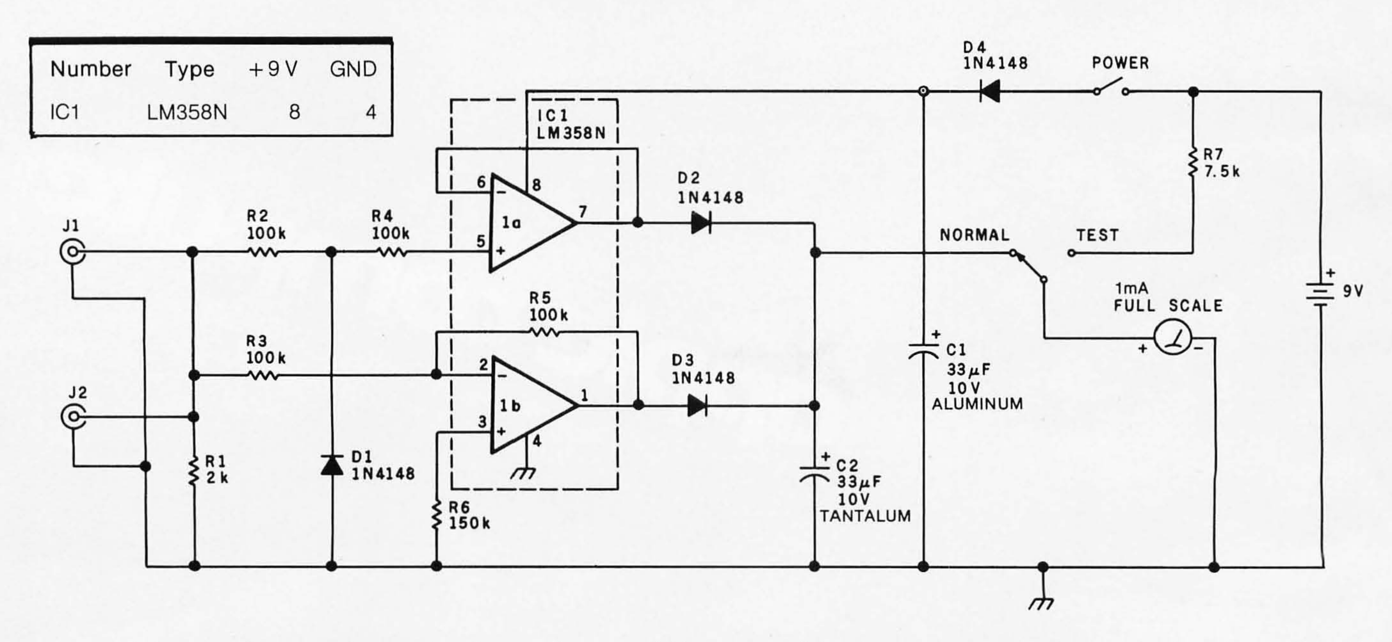
There is an adjustment mechanism, usually a small Phillips screw, on the left-hand side of most tape heads. However, some tape recorders do not allow you to reach the mechanism when the recorder is in the play mode. Because of this, it is important to do one of two things: either buy a cassette recorder that has an azimuth access hole, or have a good craftsman carefully drill a hole over the screw so that it can be reached with a tiny screwdriver when the recorder is in the play mode.

Recording with a Peak-Signal-Strength Meter

It is the peak output, *not* the average or the root-mean-square value of the cassette signal, that most tape interfaces are sensitive to. In order to repeatedly load cassette tapes on the first try, you must be able to send a signal of known strength to the cassette interface. However, most computer systems give us no feedback on cassette signal strength—in other words, we are operating "blindly." Let us use the TRS-80 Level II tape format as an example. The cassette input port terminates within the TRS-80 with a resistance of 100 ohms. A signal from the cassette with a peak level of about 2 V is needed to insure a correct load. If the cassette record/playback head is correctly aligned with the tape, and the signal is adjusted (via the volume control and our peak-signal-strength meter) to a peak level of 2 V, then the TRS-80 (or whatever computer you have) should load correctly every time.

Figure 1 presents the circuit for a peak-signal-strength meter. The signal from the cassette recorder comes in jack 1 and goes out jack 2 to the computer. Two halves of an LM358N dual operational-amplifier device are used to create a circuit that is highly sensitive to voltage changes in the 2 V region.

Although component layout is not critical, a full-size, printed-circuit-board pattern for this circuit is given in figure 2. A 9 V transistor radio battery will have a life of around 2000 hours of continuous use. The unit can be calibrated by marking the milliammeter dial while applying a known voltage from a DC 1.5 V *flashlight* battery cell; the reading should not change significantly when the polarity of the input voltage is reversed. The circuit is reasonably accurate in measuring peak voltages of signals with a frequency of up to 20 kHz, and it will then give good accurate readings as long as the 9 V battery supplies 5 V or greater.

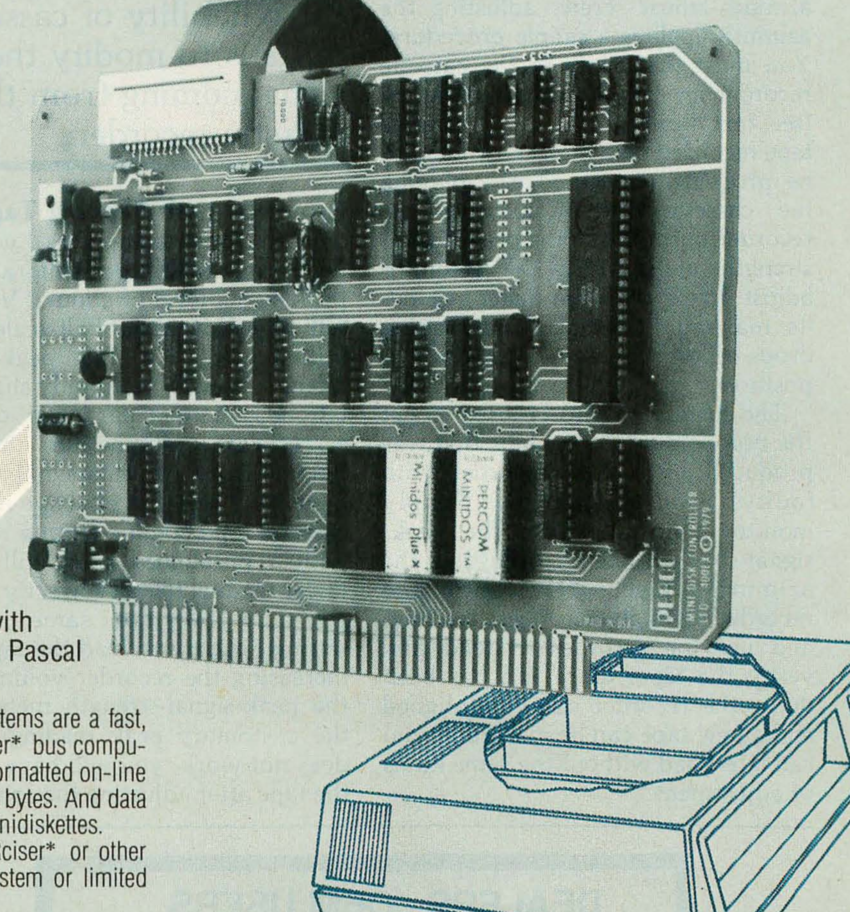


Number	Type	+9 V	GND
IC1	LM358N	8	4

Figure 1: *Schematic diagram of peak-signal-strength meter. This meter enables the user to present the cassette interface with a signal of known peak intensity—usually, about 2 V. The circuit is designed to be sensitive to voltage changes around the 2 V area.*

From Percom . . .

Low Cost Mini-Disk Data Storage for EXORciser Bus Computers



- Compatible with EXORciser* and other 6800/6809 computers based on EXORciser* bus concept.
- 40- or 77-track drives in one-, two- and three-drive configurations add 102K bytes to 591K bytes of random access data on-line.
- 40-track LFD-400EX™ drives store data on both surfaces of mini-diskettes — almost 205K bytes per disk.
- EXORciser* bus compatible controller includes 1K of RAM, provision for 3K of PROM. Mature design features explicit clock-data separator, drive motor inactivity time-out function, and more.
- Support software includes disk operating systems, a file manager, text editor, assembly language program development/debugging aids, an extended BASIC interpreter, an SPL/M compiler and business programs. Numerous programs available from other suppliers may be used with LFD-400/800EX mini-disk systems with little or no modification. Watch for FORTRAN & Pascal announcements.

Low cost Percom LFD-400/800EX mini-disk data storage systems are a fast, dependable alternative to tape storage for 6800/6809 EXORciser* bus computers. A single 40-track LFD-400EX™ drive adds 102K bytes of formatted on-line storage; a single 77-track LFD-800EX™ drive adds almost 200K bytes. And data may be stored and read from either surface of LFD-400EX™ minidiskettes.

Fast mini-disk data storage makes your Motorola EXORciser* or other EXORciser* bus computer more than just a development system or limited evaluation system.

For example, at the low LFD-400/800EX prices it becomes economical to use your development system as the final working system.

Data capture/retrieval in research, test and production environments is another application where versatile, random-access LFD-400/800EX storage can provide efficient operation.

Equipment control is yet another area where the speed and facility of mini-disk storage greatly expands application possibilities. Even if you use a mini-disk only to load and control programs you'll save simply by taking a lot less time than with slow, inconvenient tape storage. Moreover, by storing programs on fast-loading, low cost minidiskettes you eliminate the overhead of burning PROMs — an expense that quickly adds up to far more than the price of an inexpensive Percom mini-disk system.



The bottom line? An EXORciser* or Micromodule*, with percom LFD-400/800EX mini-disk data storage, is a remarkably adaptable microcomputer — a system that meets the quality and dependability demands of industry yet is competitively priced with personal computing systems.

PRICES

Model	1-drive system	2-drive system	3-drive system
LFD-400EX™	$649.95	$1049.95	$1449.95
LFD-800EX™	$945.95	$1599.95	$2245.95

MPX Disk Operating System (2-chip ROM set)
Standard versions for most popular monitors $69.95
LFD-400/800EX Users Instruction Manual:
Includes driver utility listings, controller schematic $15.00

The system prices are single-quantity prices. A system includes (1) the drives, power supplies and enclosure, (2) the EXORciser* bus compatible controller PC card with 1K RAM and provision for three 2708 EPROMs, (3) an interconnecting cable, (4) an 80-page users instruction manual, and (5) a system minidiskette. The Percom Software Services Group will customize the MPX DOS for a nominal charge if one of the standard versions is not suitable for your monitor. LFD-400EX™ systems use 40-track drives; store 102K bytes of formatted data per minidiskette side. LFD-800EX™ systems use 77-track drives; store almost 200K bytes on one side of minidiskette.

Orders may be placed by dialing 1-800-527-1592 (outside of Texas) or (214) 272-3421 (in Texas). For additional technical information dial (214) 272-3421.

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421



™ trademark of Percom Data Company, Inc. * trademark of Motorola Corporation

Prices & specifications subject to change without notice.

Checking the Recorder Azimuth

If your tape recorder has an azimuth-adjust screw, adjusting the azimuth angle is a simple procedure. You must first place in the cassette recorder an azimuth-calibration tape (see text box) or a similar cassette tape recorded on a machine *known* to be properly aligned. Then, playing the cassette and monitoring the recorder output with the peak-signal-strength meter, turn the azimuth-adjust screw until the meter reaches its maximum reading. The reading drops off on both sides of the optimal position.

The meter can also be used to get the best reading from a tape that was produced on a tape recorder with faulty head alignment. Simply monitor that tape with the peak-signal-strength meter, adjusting the azimuth-adjust screw until the recorder gives the strongest reading, and use the recorder to load and verify the tape. Once this has been done, the recorder can be realigned and a new tape can be made that you can later load without the same kinds of adjustment.

One method of improving the reliability of cassette tapes is to modify the signal coming from the cassette recorder.

Problems with Reading Tapes

With most computers, you will need to load a tape using an input peak-signal level of about 2 V (which will appear as about half-scale on the milliammeter of the peak-signal-strength meter). With only slight variations due to a particular computer/recorder combination, the same reading from the peak-signal-strength meter will result in effective loads. A cassette tape coming from a recorder with a misaligned head will give a lower reading than a correctly recorded tape for the same volume setting.First try to load the tape after increasing the recorder volume until the peak-signal-strength meter gives the customary peak reading. If this does not work, you will have to load the tape after adjusting the azimuth in the manner previously described.

Whenever the tape head is misaligned with respect to the tape path, the peak-signal intensity will flutter, even if the tape being played was recorded correctly. This effect is called *skew*. If the signal variation is severe enough, you will be unable to load the tape properly due to data dropout. Signal flutter due to skew is a subtle problem; it will not show on a meter because no meter needle can move fast enough to follow the flutter.

Flutter can also be caused by *tape weave*, which has a variety of causes. If the pressure pad opposite the record/playback head is not positioned properly, it will tend to push the tape away from the center of the head. This is aggravated by the fact that most cassette recorders do not maintain tension on the supply reel, allowing the pressure pad to pull out tape freely and push the tape away from the center line of the head. Also, a tape with a thin backing is more susceptible to tape weave.

Altering Tape Waveforms

Another method of improving the reliability of cassette tapes is to modify (and sometimes rerecord) the signal coming from the cassette recorder. For example, several waveform-changing interfaces that improve the loading reliability of the cassette are available for the Radio

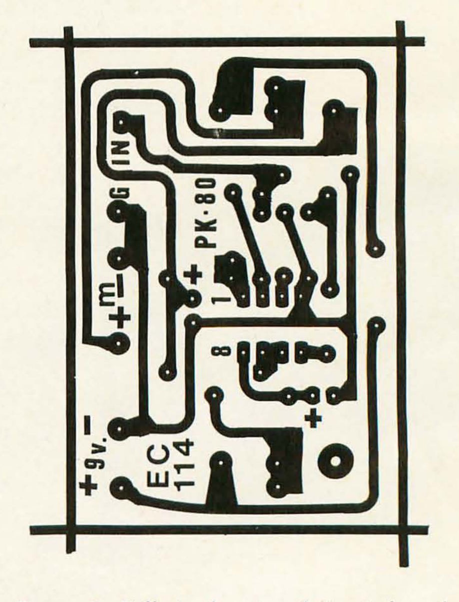
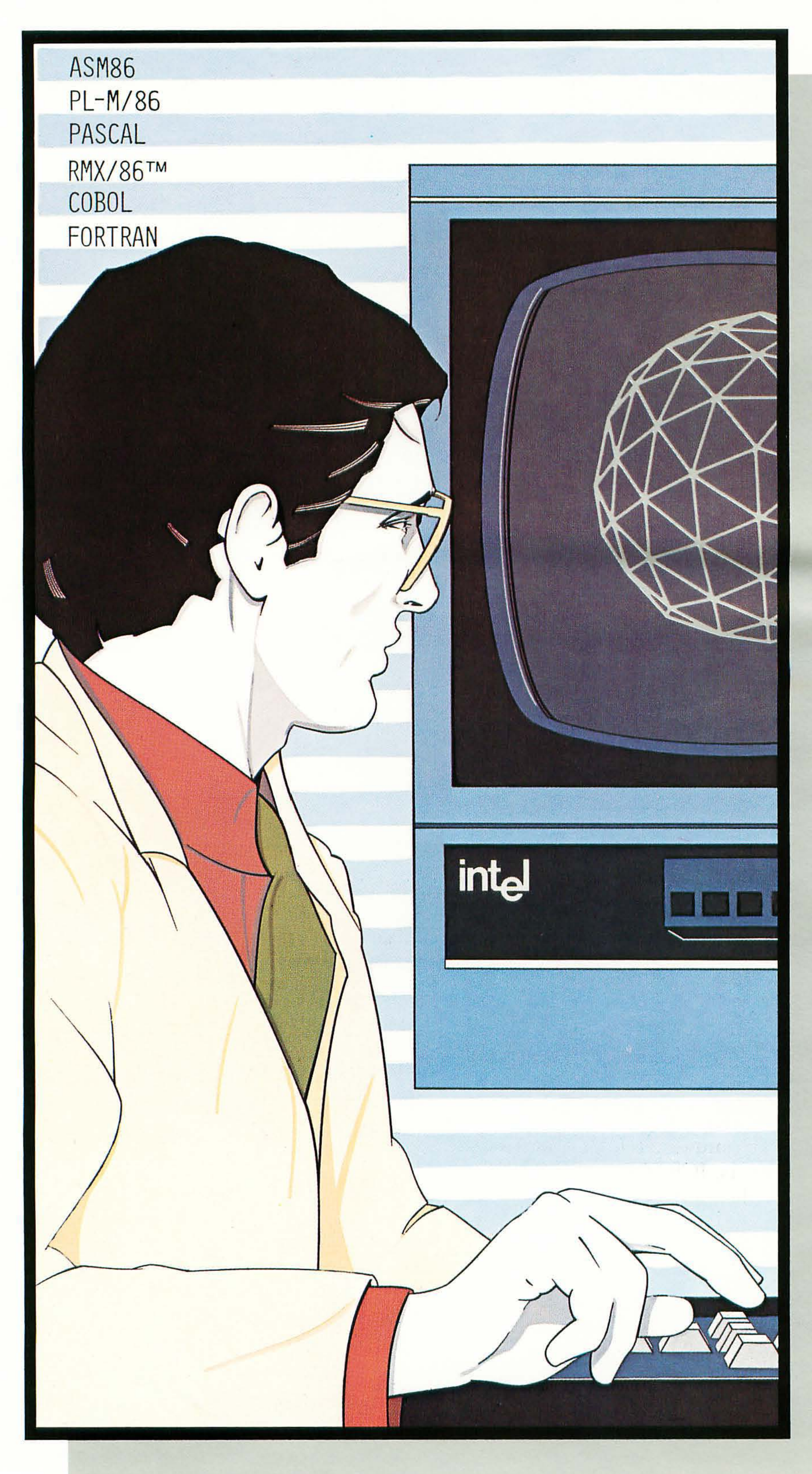


Figure 2: *Full-sized, printed-circuit-board pattern for the peak-signal-strength meter circuit of figure 1.*

There is only one high performance VLSI computer solution.

Intel delivers it.

Tools to solve the



How Intel delivers the key to productivity in the '80s.

As we move into the '80s, the increasing demand for complex computer programs, the critical shortage of programmers, and the seemingly unstoppable rise in software development costs will reach crisis proportions. To understand how to bring this situation under control, we have to understand its cause.

In the 1970s, the microcomputer was used successfully to lower the cost of hardware engineering. Each new microcomputer generation integrated more and more of the system, lowering the cost of design and making it easier to put electronic intelligence anywhere and everywhere. As hardware cost dropped, rising software costs became increasingly visible.

So, today, as costs climb, management puts everyone under increasing pressure to deliver projects on time and on budget. Yet, the cost of programming is still outpacing productivity. Software development and integration still lag the system hardware. The software crisis of the '80s rages on.

Tools for structured solutions

Once a problem grows beyond a certain point, the most efficient way to solve it is with a top down approach. You break the problem into units, program and debug each one, and combine the units into a unified solution.

That's the concept. But you can't stop there. In the '80s, bridging the gap between a conceptual solution and a working one will require tools as efficient as the top down method. New tools, like a CPU with a dramatically different architecture. An architecture uniquely suited to a world of higher level languages and structured programming. Tools like a modular operating system, of a kind never before available on a 16-bit microprocessor. Tools like the

software crisis.

only complete family of programming languages, because no one language is right all the time.

Different languages have different strengths and weaknesses, and using the right language for the right job can make your programming easier. So, Intel delivers ASM86 Macro Assembly Language for space and speed sensitive modules. Our PL-M/86 systems programming language and PASCAL support structured programming at the systems and applications levels. FORTRAN and COBOL will also be available.

With Intel's relocation and linkage tools, modules written in the different languages are combined, with library utilities and operating system routines, into one, complete solution, automatically. Using this modular approach, and the right language for the right job, your finished product is clean, reliable, maintainable, and understandable.

Peripheral Controllers
Co-processors
Microprocessors
Memories
Software
Software Development Systems

Intel Structured System

The critical module

Since complex software requires sophisticated operating systems support, the operating system is the most critical module in your solution. It is the foundation upon which your application is built. It is also available, off the shelf, from Intel.

Today, Intel delivers the RMX/86™ operating system. RMX/86 is new, and it's the first modular, real-time, multitasking operating system for 16-bit microcomputers. File manipulation, task scheduling, and interrupt control are configured by you, according to the needs of your application. There's no unnecessary burden.

Intel's investment in the development of RMX/86 is substantial. Depending upon the features you select, you save from two to forty man years of programming effort. That's an additional two to forty man years you can devote to your application.

Tools for realizing your solution

Of course, having the foundation and the concept of your solution doesn't help if you can't write the programs to implement it. So, Intel delivers development tools to support you through the entire development cycle. Support from source entry, with CREDIT, a CRT based text editor, through compiling and debugging, with an Intellec® development system and ICE™ hardware/software debugging system. Intel's tools work with you. They shorten development time and support the structured approach you've taken.

But debugging software on a development system is not the same as testing it on the actual hardware. The ICE modules help here, too. During development, these tools let you trace through your software and debug it, symbolically, at the source language level. Now, these In-Circuit Emulators replace your prototype hardware's CPU to speed hardware/software integration.

If your hardware is built from components, ICE Modules will help you separate the hardware and software bugs, so you don't spend your time fixing engineering problems. If your hardware is built around an Intel iSBC 86/12A™ Single Board Computer, you'll already have a known, working hardware environment for program testing. You can use ICE Modules to concentrate your efforts on debugging your software.

Either way, the same software, operating system support and debugging tools are available to help you bring your application to life.

Synergy for high performance

In the '60s and '70s, programs were used to instruct computers. Applications of the '80s require programs to be the solutions to problems. High performance solutions will be the result of synergy between the hardware and the software.

To create this synergy today, Intel delivers the 8086 processor. The 8086 processor is unique. Instead of a linear, or flat architecture, the 8086 is the only microprocessor optimized to work with high level languages and the structured solutions they implement.

For the specialized needs of the '80s, the 8086/87 and 8086/89 co-processing systems will set the standard of performance for mathematical processing and I/O bound applications.

And Intel peripheral controllers contribute to your system throughput by freeing processors for more computation.

Your software design may be revolutionary. And with help from an architecture designed to support your structured solution, its performance can be revolutionary, too.

Intel's software tools let you concentrate your planning on the payoff—getting to market today with a superior product. To take your first step to higher productivity, fill out and mail the coupon on the other side of this page. It's a productive use of your time.

intel® delivers solutions.

Europe: Intel International, Brussels, Belgium.
Japan: Intel Japan, Tokyo. United States and Canadian distributors: Alliance, Almac/Stroum, Arrow Electronics, Avnet Electronics, Component Specialties, Hamilton/Avnet, Hamilton/Electro Sales, Harvey, Industrial Components, Pioneer, L.A. Varah, Wyle Distribution Group, Zentronics.

Your first step toward productivity

How to get more information on solving the software crisis of the '80s.

To find out more about our solutions, fill out the information requested below and send it to Intel Corporation, Literature Department, 3065 Bowers Avenue, Santa Clara, CA 95051. Indicate what your particular interests are, including workshops, and we'll make sure you get the appropriate material. If you don't have a pair of scissors handy, give us a call at 408/734-8102 (Literature Department) and we'll rush the material out to you. Or call your local Intel distributor.

Intel wants to help you solve the software crisis of the '80s. It all starts right here.

Name ______________________

Title ______________________

Company ______________________

Division ______________________

Address ______________________

City, State, ZIP ______________________

___ I have an immediate requirement, please telephone me at (   ) ______________

___ I need additional information.

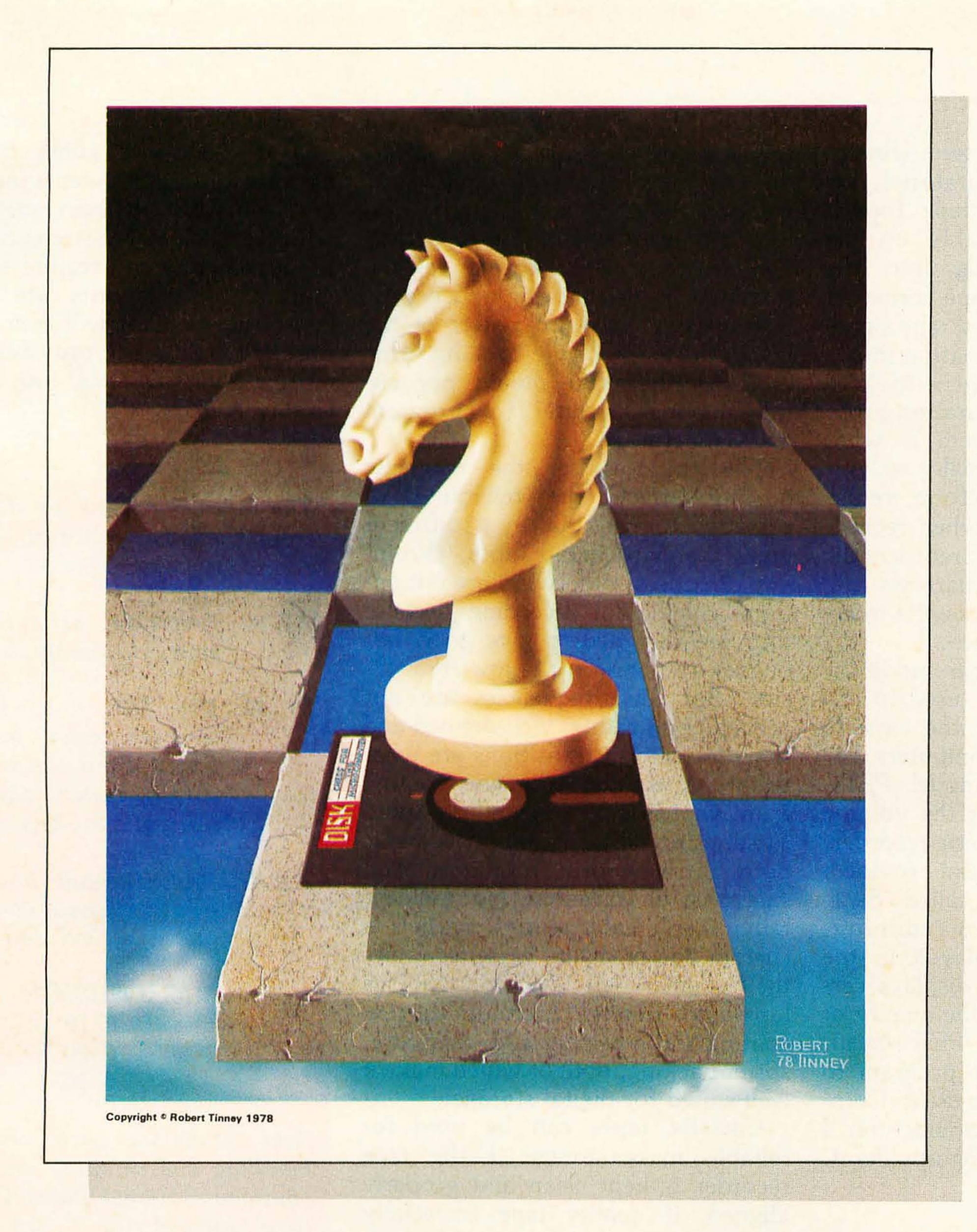
Please put the letter corresponding to your yearly requirements in the line to the left of those products of interest.

W for 1-10 per year
X for 11-99 per year
Y for 99-999 per year
Z for over 1,000 per year

___ A 16-bit Microprocessors
___ B 8-bit Microprocessors
___ C Single-Chip Microcontrollers
___ D Peripheral Controllers
___ E RAMS
___ F EPROMS
___ G Bubbles
___ H Single Board Computers
___ I Development Systems
___ J Debug Tools
___ K High-Level Languages (______________ Indicate languages)
___ L Macroassembler
___ M Operating Systems (RMX/86™)
___ N Telecom Products
___ O Military Products
___ P Workshops

012345

Circle No. 426 for information.



Copyright © Robert Tinney 1978

Beautiful "Computer Chess" Reproduction—only $4.95!

This dramatic reproduction of the October '78 Byte cover art has been produced with the same care and quality as limited edition prints—yet it is available for the price of a poster.

The overall size is 18" x 22", which includes a 1½" border. It is printed on heavy, 80 lb., matte finish, coated stock, excellent for the finest framing if desired.

The price of this quality reproduction is $4.95, plus $1.00 for mailing tube, handling, and postage. In addition, the artist, Robert Tinney, will select the 100 finest prints from this first edition for his personal signature and number. These 100 signed and numbered prints will be sold on a strictly first-come basis for $24.00 plus $1.00 postage and handling.

See coupon below for ordering.

Send me ____ of the $4.95 posters, and ____ of the $24.00 signed prints. I have included $1.00 for postage and handling.

Please charge this to my Visa/Master Charge:

Visa card number: ____

Master Charge no: ____

Card expires: ____

signature ____

Name: ____

Address: ____

City: ____ State: ____ Zip: ____

Make check payable to:

robert tinney graphics

P.O. Box 45047

Baton Rouge, LA 70895

Shack TRS-80. About two winters ago here at Cook Laboratories, we developed a modified tape format that records more reliably on the TRS-80. Without going into the details of the TRS-80 tape format, I can say that the unaltered tape signal crowds too much information into a given space and thus opens itself to reliability as well as saturation problems. The latter problem is what makes the TRS-80 normally so volume sensitive. The waveform we use at Cook Laboratories, when recording tapes for the TRS-80, reorders the waveform shape and narrows the pulse width so that the cassette interface does not get confused.

The various waveform modifications could certainly be used to improve the reliability of the cassette storage on other microcomputers. For example, on the old-model PETs, there is no way to alter the volume level of the built-in cassette recorder. However, Commodore can provide a documented program called S-21. This program, when running, monitors tape being played in the PET cassette deck and displays certain information about the quality of the tape signal on the PET screen. This is a very effective program to have if you know how to use it; Commodore is the only manufacturer I know that supplies a program like it.

Tape Is Also a Factor

Several factors having to do with the cassette tape itself can also affect the reliability of tape loading. As I mentioned before, a tape that is too thin will likely give in to tape weave. Tape stiffness is a property of the thickness of the backing and is proportional to the third power of the gauge thickness of the backing. This indicates that you should not use long-playing cassettes for program and data storage.

The thickness of the magnetic coating affects the reliability of cassette storage, but in a different way. Standard audio tapes, chromium dioxide or otherwise, are not optimal for digital recording because they are designed to give good frequency response in the low frequencies. But low frequencies are not needed here; rather, well-defined and sharp waveform transitions are what count. A thinner magnetic coating than what is used in standard audio cassettes results in nice improvements both in waveform resolution and sharpness of transition. Not incidentally, Cook Laboratories markets a custom line of digital cassettes under the trademark MICROFUSION. This tape has a thinner chromium dioxide coating and a heavier and, therefore, stiffer backing, both of which make it well suited for digital storage.

Cassette tapes can be used for reliable mass storage if the tape recorder is kept clean and properly aligned, if quality tape (especially tape made for digital storage) is used, and if the signal going from the cassette to the computer is monitored and kept constant (from tape to tape) with a peak-signal-strength meter. Although disks are readily available and bubble memories are not far away, no medium will ever become obsolete as long as it provides a needed function. Cassettes, too, are here to stay. ■

The following items are available from Cook Laboratories, 375 Ely Ave, Norwalk CT 06854:

AZ-80 Precision azimuth cassette, chromium dioxide. $14.95

PK-80 Kit for peak-signal-strength meter, including board, litho panel, screwdriver, meter, case, and instructions, less battery $25.90

AZ-B1 Printed-circuit board for peak-signal-strength meter, etched and drilled $2.50

MICROFUSION digital cassette, C-10 $3.26
C-20 $3.68
C-30 $4.09

Add $2.00 for each order for handling and shipping within the continental United States. Connecticut residents add 7% tax.

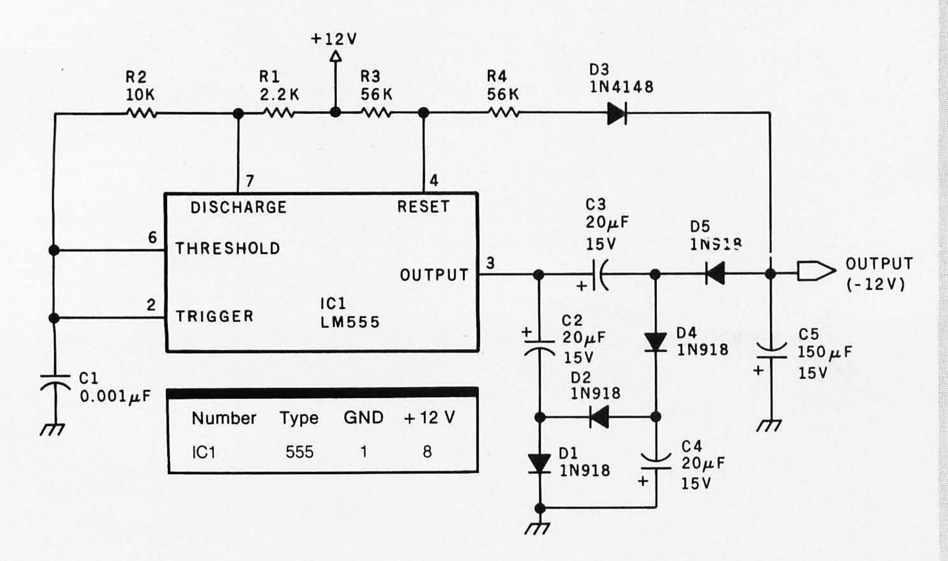
A DC-to-DC Converter

Michael Picco
POB 516
Corte Madera CA 94925

Have you ever had the need for a bipolar power source, but had only a positive voltage available? With the help of a timer and a few external components, this problem can be overcome. The circuit in figure 1 is sufficient for powering op amps or similar devices requiring a supply current of 25 mA or less at −12 V.

The heart of this circuit is a 555 timer that provides a drive signal of approximately 20 kHz to a voltage doubler. This signal is removed if the magnitude of the output voltage exceeds that of the supply voltage. In this sense, the converter operates as a switching-mode regulator.

The output voltage is set by controlling the timer via the reset input (ie: pin 4). When the output voltage reaches a negative potential with the same magnitude as the supply voltage, a low logic state is placed on the reset input, causing the timer output to go low and the increase in voltage magnitude to cease.■



Number	Type	GND	+12 V
IC1	555	1	8

Figure 1: *Schematic for the DC-to-DC converter. The 555 timer produces a rectangular wave at about 20 kHz, which is inverted by the diode-capacitor voltage-doubler arrangement. A feedback signal reaching the reset pin of the 555 regulates the magnitude of the output, which is −12 V at 25 mA.*

Circle 9 on inquiry card. →

We see the Apple a little differently.

We see it as a good way to get things done.

Apple has built a great computer. We at CCS have built a great line of peripherals and components to expand the Apple. To do almost anything you want to get done with a computer.

If you want to do business with an Apple, we've got tools to connect the Apple to standard business printers and terminals. Or to modems, for communications over telephone lines, with other computers, even with other Apples.

If you want to apply your Apple to engineering, scientific, or graphic projects, we've got tools for high-powered, high-speed math functions, and fast, high resolution graphics. And tools to connect the Apple to lab test equipment like function generators or plotters.

And we have tools to connect the Apple to the outside world, including A/D converters and interval timers with external interface.

We make components for the S-100 bus, the PET, and the TRS-80, too. We built our products to deliver hard-nosed value to the OEM, and to the inventor who knows the best, at prices that are unbeaten.

To find out how much computer your Apple II can be, see things our way. Because for serious users with serious uses for the Apple, we've got the tools.



California Computer Systems
250 Caribbean Sunnyvale, CA 94086 (408) 734-5811

I/O Expansion for the Radio Shack TRS-80

Part 1: Principles of Parallel Ports

Steve Ciarcia
POB 582
Glastonbury CT 06033

I receive a lot of mail: enough that I'm beginning to feel like the "Dear Abby" of the personal computer ranks. The sources of the letters range from high school students asking for advice on science fair projects to major corporations seeking consultant services. Even though it takes considerable time to answer this mail, I regard it as a significant opportunity to gauge reader interest. Every letter in some way contributes to my choice of article topics, either through suggestions or by continued occurrence of similar questions.

Recently, my mail has been dominated by owners of the Radio Shack TRS-80 Model I thirsting for hardware expansion by means other than Tandy Corporation equipment. The majority of questions concern connection of my interfaces to the TRS-80 expansion connector.

In general, I have tried to present projects that are computer independent. That is, the interfaces described are driven through parallel input/output (I/O) ports rather than directly from a computer bus. This had not been a problem in the past, because virtually all of the early personal computers incorporated some parallel I/O capability. For those experimenters interested in enhanced I/O capabilities, I presented the article "Memory-Mapped I/O" in the November 1977 BYTE on page 10 (reprinted in *Ciarcia's Circuit Cellar* Volume I, BYTE Books), which detailed parallel-port construction.

In the 2½ years since that article was first published, a number of significant changes have occurred in personal computing. Most importantly, the Radio Shack TRS-80, the Apple II and the Commodore PET were introduced. The difficulty in maintaining and operating a computer is no longer a serious consideration for most computer enthusiasts. Much of my mail indicates that a new explanation of parallel and serial I/O is in order, and that it is time for hardware-expansion circuits to be detailed.

A *port* is a hardware channel for the computer to transmit and to receive *data* via an *external* peripheral device.

This month's Ciarcia's Circuit Cellar is the first of a two-part article on serial and parallel I/O port expansion of the TRS-80. The first part emphasizes parallel I/O, and the second part is concerned with serial interfacing. The result will be a complete Radio Shack software-compatible communications interface capable of supporting a variety of serial- and parallel-interfaced peripheral devices. The hardware was designed and the components were selected to be economical to build and easy to check out. First, here is a brief review of the basics.

What Is an I/O Port?

Just as some people are initially confused with the terms *hardware* and *software*, some find the concept of input and output ports difficult to understand without substantial explanation. The classical definition: a *port* is a hardware channel for the computer to transmit and receive *data* via an *external* peripheral device. The key words in this definition are *external* and *data* which imply externally collected information; the channel through which this data is obtained is called a *port*. A printer is a typical external peripheral device. The characters to be printed are sent from the computer to the printer. In some of the more sophisticated units, status signals such as *busy* and *out of paper* are returned to the computer from the printer.

Ports can be either parallel or serial. In *parallel* mode, data is transferred in increments equivalent to the word size of the computer. On the Z80, for instance, an 8-bit microprocessor, an output instruction through a parallel port transfers 8 bits at a time. A 16-bit processor such as the Intel 8086 transfers data in 16-bit increments. The number of bits transmitted simultaneously by a parallel port is dependent upon the size of the microprocessor data bus and how many bits the processor can transfer simultaneously.

However, serial data is always transmitted a single bit at a time, according to a fixed schedule defined by the data rate (usually expressed in bits per second, or *bps*) and a few specific options. The microprocessor has no single instruction that transmits serial data. It must rely on another device called a universal asynchronous receiver/transmitter (UART) to put the data word into serial form and transmit it. Any communication between the processor and the UART is in parallel form and is done through the processor's memory reference or I/O data-transfer instructions. A more in-depth discussion of serial ports will be presented next month in Part 2.

Address, Data, and Control Buses

Consider a computer system that includes a printer, video terminal with keyboard, and an audio cassette recorder as peripherals. Data would have to be relayed to the printer, to and from the video terminal, and to and from the cassette recorder. How can the computer tell the difference between data destined for the terminal and the data destined for the printer?

Most microprocessors incorporate a bidirectional *data bus* and an *address bus*: this is shown in figure 1. To keep track of the data transfer between the processor and its peripherals, the system uses a quantity of control signals which together can be called the *control bus*. The usual 8-bit processor has an 8-bit data bus, a 16-bit address bus, and a dozen or so control signals.

When the microprocessor is reading a data byte from memory, the address of the memory location being referenced is placed on the address bus. Memory information stored at that location goes on the data bus and flows from memory to the processor. When data is being written into memory, the operation is reversed. A 16-bit address bus allows the processor to directly address 65,532 (ie: 64 K) memory locations.

In an 8080 or Z80 processor there is a specific set of instructions that perform input/output functions. The operation of these I/O instructions is similar to that of memory-reference instructions, except that only 8 bits of the address bus are used. These 8 bits

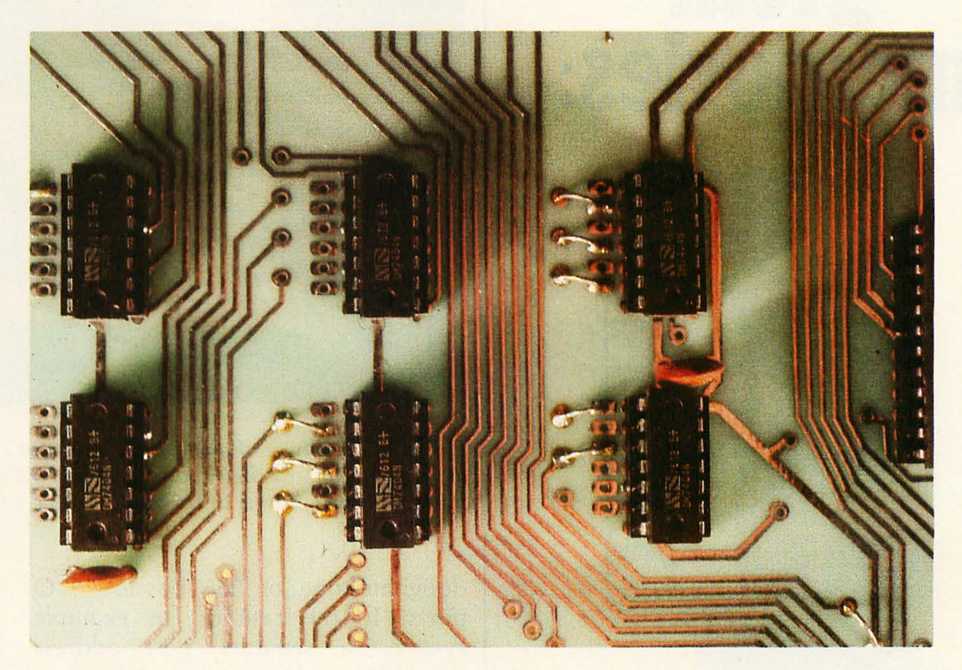


Photo 1: *There are a variety of ways to decode the address for a particular input/output (I/O) port from the signals present on the address bus. The least expensive method uses inverters and printed-circuit-board jumpers to select the correct logic polarities. Three address lines are connected through each 7404 hex inverter with two possible connections for each address line. A connection to the upper trace on the circuit board decodes a logic 1; a connection to the lower trace decodes a logic 0.*

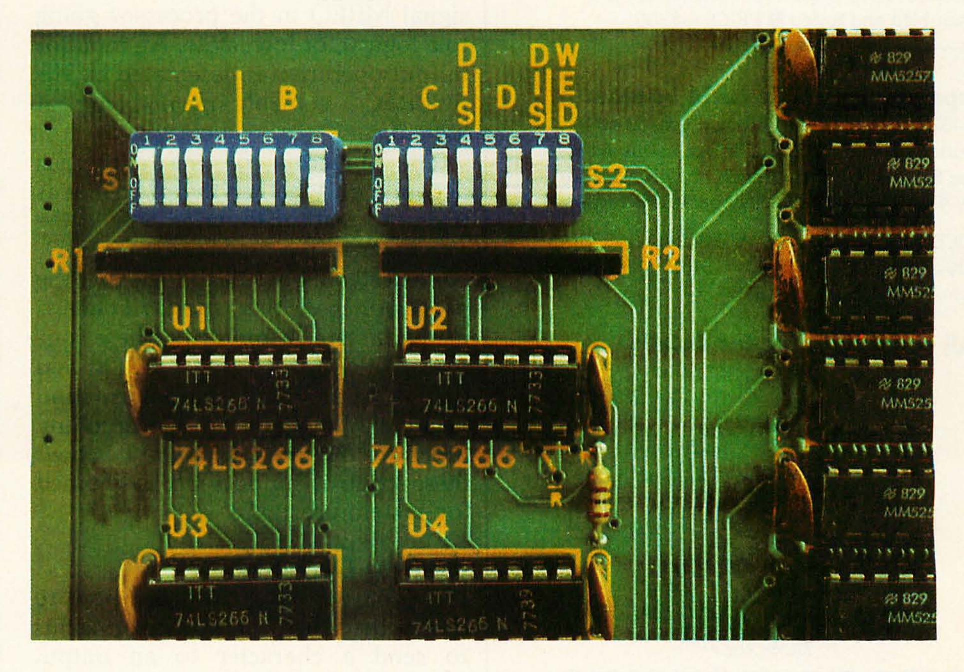


Photo 2: *A more expensive and more easily changed addressing scheme employs dual-in-line-pin (DIP) switches and exclusive-NOR gates. The schematic diagram for this is shown in figure 3b.*

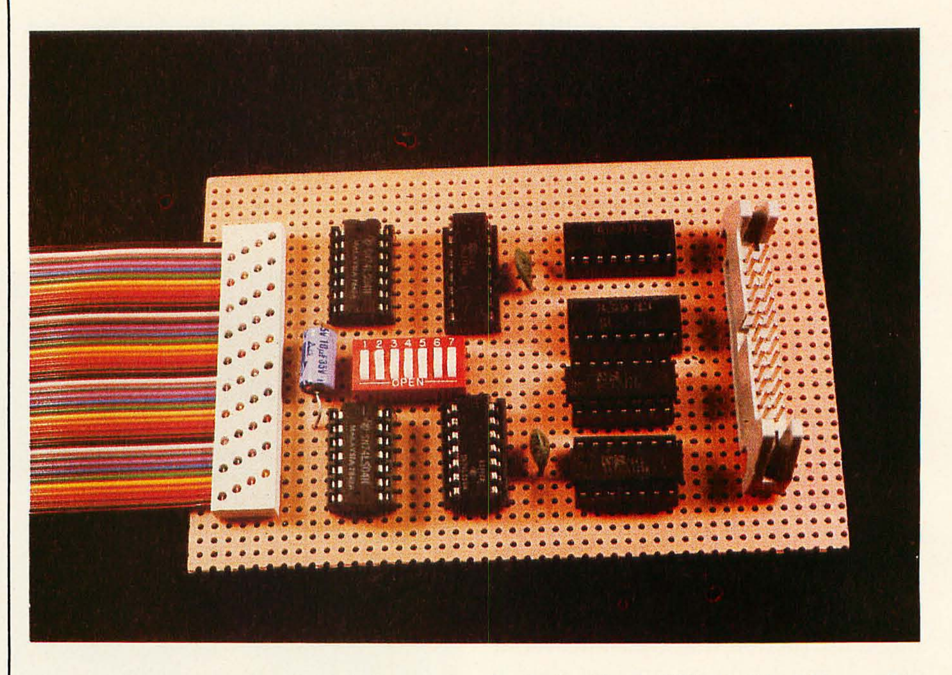


Photo 3: *Prototype of an 8-bit I/O port for the Radio Shack TRS-80. The ribbon cable at left connects to the expansion port on the keyboard/processor unit. The two I/O ports are brought out to the ribbon-cable connector on the right edge of the board.*

designate one of 256 possible I/O ports. In the case of the example system, a separate port address would be used for each peripheral.

Keeping track of bus direction and information flow is a matter of properly decoding the control signals during program execution. In a Z80 for instance, any memory-reference operation is signified by the control signal $\overline{MREQ}$ in the processor going to a logic 0, or low, state. An input or output operation is designated by the $\overline{I/OREQ}$ control signal being at logic 0.

The direction of the data bus depends on whether the processor is trying to read or to write data. If the processor is in a read mode, the $\overline{RD}$ control signal becomes a logic 0; if the processor is writing, the $\overline{WR}$ line is in the 0 state. Monitoring these four lines, $\overline{MREQ}$, $\overline{I/OREQ}$, $\overline{RD}$, and $\overline{WR}$, gives us all the information necessary to support I/O decoding functions. Figure 2 demonstrates how these control outputs are combined for system use.

Address Decoding

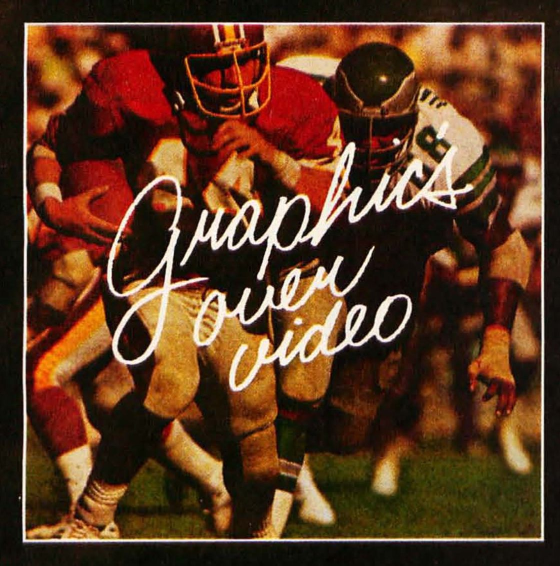
So far we have discussed how to determine when the processor wants to send a character to an output device. In such an operation the $\overline{I/OREQ}$ and $\overline{WR}$ lines are both low. To tell the difference between data for the printer and data for the terminal, we must decode the 8-bit port address.

The port address is determined by the logic voltages present on the low-order eight lines (that is, the 8 least significant bits) of the address bus during I/O operations. Various techniques can be employed to decode these lines. Figure 3 outlines a few simple methods. The objective, whatever the logic employed, is to produce a single pulse (ie: a strobe) whenever the logic states representing a particular address appear on the address bus. To eliminate false outputs when the processor is executing instructions not dealing with I/O, it is best to combine control and address signals as demonstrated in figure 4.

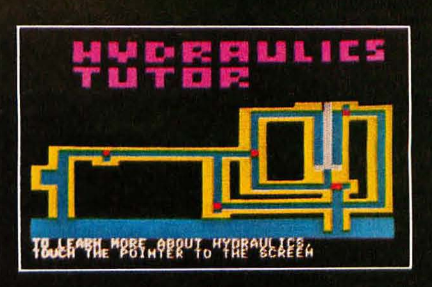
If you own a 6800- or 6502-based system, you have probably noticed that the processor has no special I/O instructions. This does not mean that these processors have no external communications capability, only that these processors communicate with peripheral devices differently. How can we discover this different method? Let us begin by looking closely at the I/O functions of the 8080 and Z80 that we have just discussed.

A close inspection of the I/O functions of an 8080 or Z80 should point

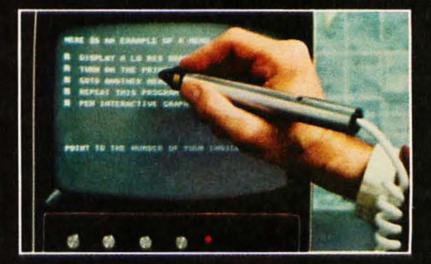
Text continued on page 30













VIDEO DATA PROCESSOR
Called the VDP, comes complete with 16K memory, its own color text and graphics generator and is designed to superimpose its graphics and text over incoming video signals from video tape, video disk, TV camera, Apple Video or Broadcast • Color text and graphics on an independent screen • Video titling or video interactive training uses. It's like your own TV station, works with OUR Light Pen too! Available directly from Symtec at $1500.00.

SPECIAL PROBLEMS
We can help. Symtec does custom engineering, fabrication, hardware and software design for microprocessor. Beginning at $1500, these services can solve your custom application needs for industrial, scientific, medical, engineering or personal uses.

SUPER SOUND GENERATOR
Apple Music Power with a plus • 3 voices, 6 in stereo version • Noise generator • Independent control of volume, envelope and shape by channel • Full power, easy to use software to compose, edit, play in hi-res graphics, PLUS, input and output ports allow extra uses: • Printer interface • Remote ASCII or music keyboard interface • and, optional BSR X-10 Adapter is available. Suggested retail $159.95 mono, $259.95 stereo.

SYMTEC X-10 CONTROL
Now for the Apple II, a low cost control to link your computer to the BSR X-10 Home Control System. Control your home or office lighting and appliances • Energy management • Display lighting Security and more. Suggested retail $49.95.

LIGHT PEN
A professional quality, full feature light pen for the Apple II Computer • Hi-resolution — draw on the screen • X, Y and sensitivity adjustments — fits any standard TV • Sync adjustment for remote video source • Touch switch sets interface flag • Rugged metal case • Recommended by Apple. Complete, ready to go, the Symtec Light Pen is provided with software and documentation in Basic, Applesoft and machine code. Muse's Pilot II Language using the Symtec Light Pen is also available. The Light Pen is useable for graphics, games, education, exhibits, freedom from the keyboard. Suggested retail $249.95.



See your Apple Dealer for a demonstration of the Symtec Light Pen, Supersound Generator or Symtec Apple X-10 Control. Other products and services are available directly from Symtec. Apple is a trade mark of Apple Computer Inc. BSR System X-10 is a trade mark of BSR Ltd. Muse is the trade mark of Micro Users Software Exchange, Inc.



22223 Telegraph Rd., Southfield, Mich. 48072 P.O. Box 462, Farmington, Mich. 48024 313-352-1790

Circle 12 on inquiry card.

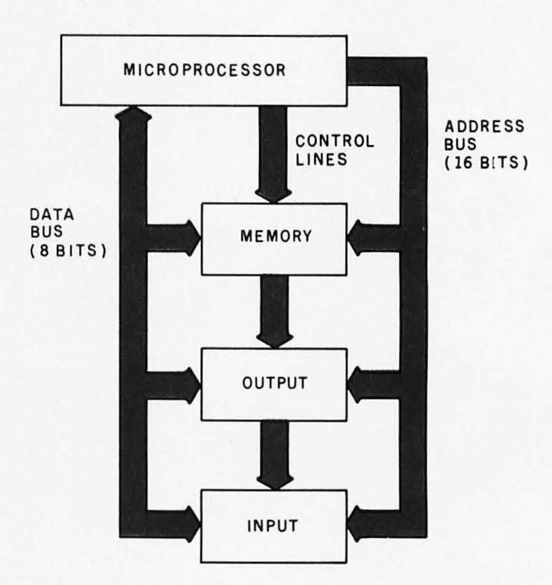


Figure 1: *Block diagram of a microcomputer system that uses an 8-bit microprocessor such as the Z80. This system uses bussing techniques that are both multiplexed and bidirectional.*

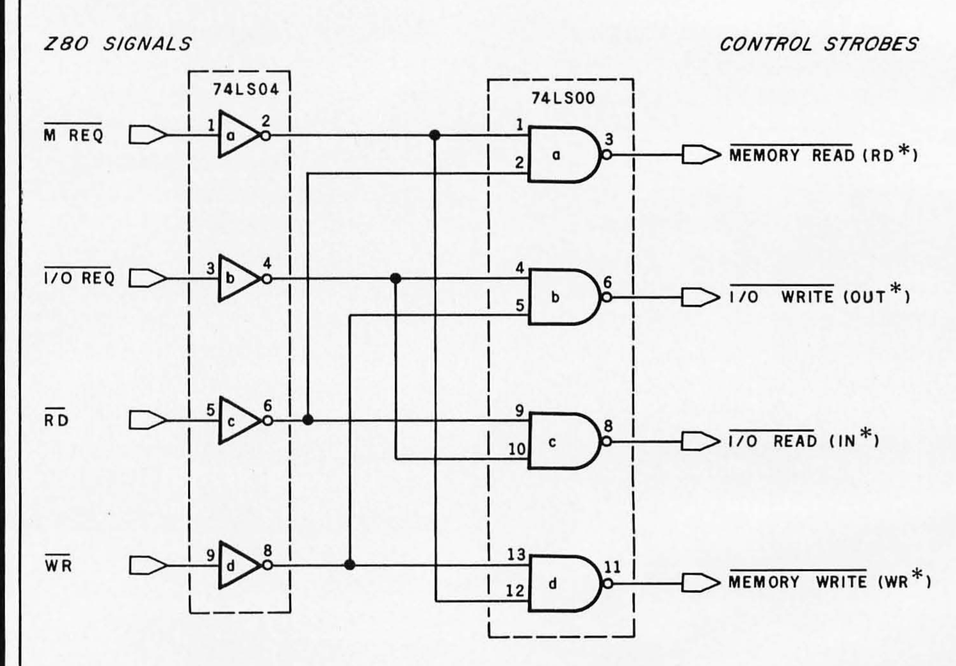


Figure 2: *Control signals on the Z80 microprocessor. The Z80 uses a variety of control signals to keep data flowing at the right time and in the right direction. Four control signals are as follows: the $\overline{MREQ}$ line goes to a low state (ie: a logic 0) when a memory- reference operation is in progress; the $\overline{I/OREQ}$ line goes to a low state when an input/output (I/O) operation is in progress; the $\overline{RD}$ line goes low when the processor is reading data from memory or from a peripheral device; the $\overline{WR}$ line goes low when the processor is writing data to memory or to a peripheral device. The $\overline{RD}$ and $\overline{WR}$ signals control the direction that data flows along the bidirectional data bus. Monitoring these four lines gives us all the information necessary to support I/O decoding functions.*

Signals from the four processor control lines are logically combined to form control-strobe signals that perform specific functions. The characters in parentheses give the names by which the control-strobe signals are known in the documentation for the Radio Shack TRS-80.

Circle 13 on inquiry card. →

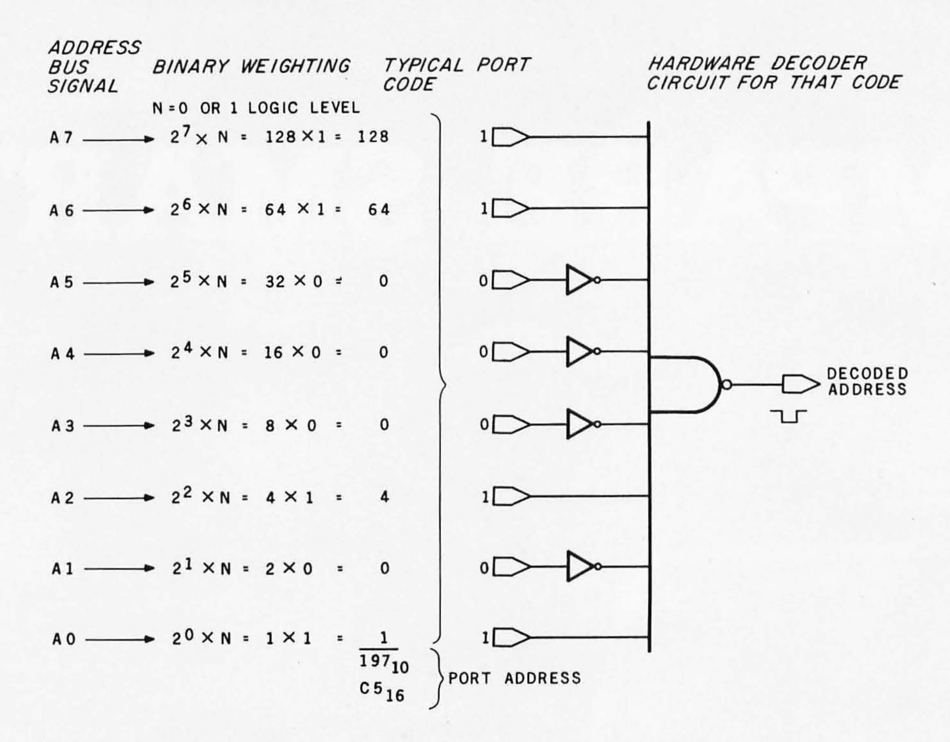


Figure 3a: *Various methods can be employed to decode the address signals that appear on the address bus during I/O operations. Here, various inverters and an eight-input NAND gate are hardwired in a configuration that will produce a logic 0 output for one of 256 possible I/O port addresses. The logic 0 output can be used to activate the interface for the peripheral device. Here the circuit decodes the address hexadecimal C5, or decimal 197.*

Number	Type	+5 V	GND
IC1	74LS85	16	8
IC2	74LS85	16	8
IC3	74LS04	14	7

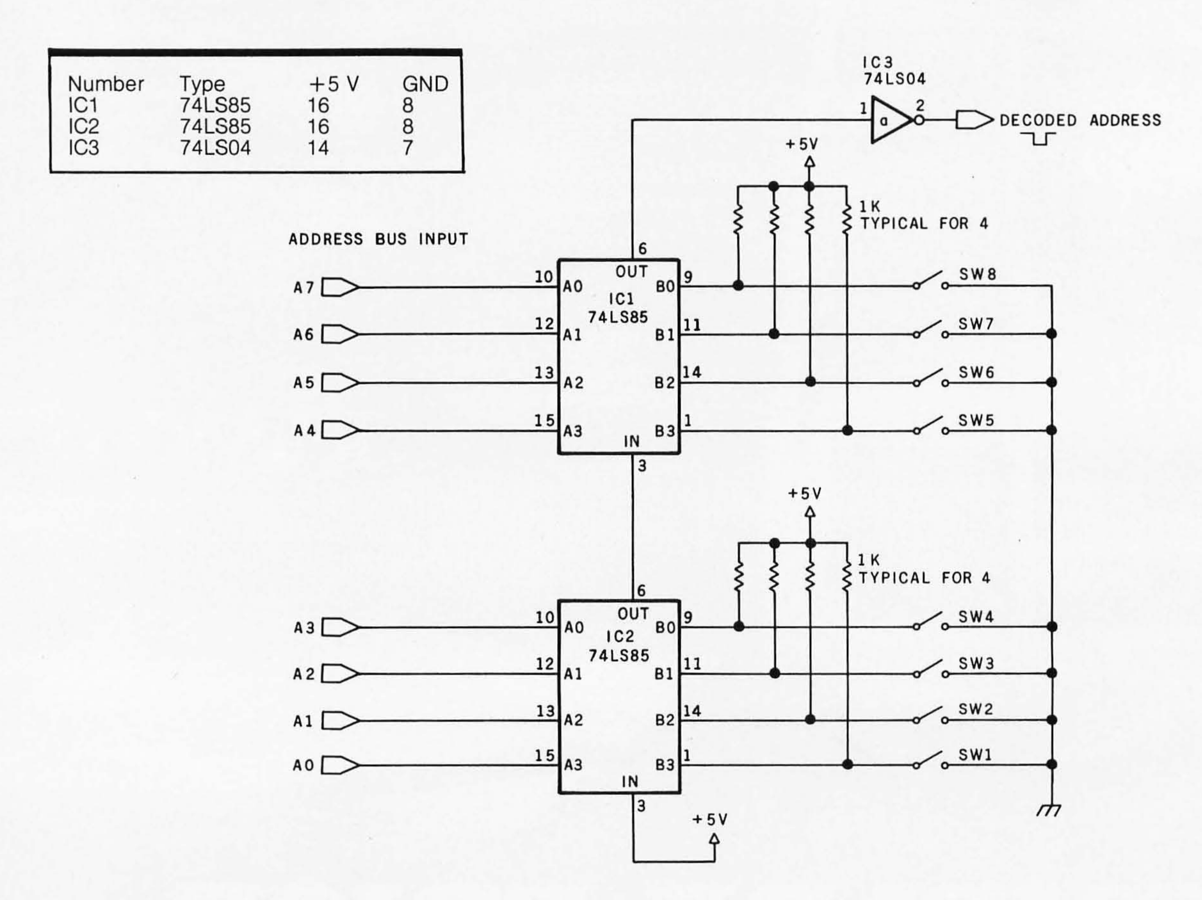


Figure 3b: *Another method of decoding an address signal. Two 4-bit comparators can be cascaded together to decode an 8-bit address. The desired 8-bit port address is set up on switches SW8 thru SW1. When the combination of high and low logic states that corresponds to the desired address appears on the address bus, the output signal produced at pin 2 of IC3 (the 74LS04 inverter) will go low to a logic 0 state. This decoding method allows the port addresses to be easily changed, but the method here is considerably more expensive than the decoding method shown in figure 3a. The switches are single-pole, single-throw (SPST) types; an open switch shows logic 1, and a closed switch shows logic 0.*

Now! North Star Application Software!

North Star now offers application software for use on the HORIZON! Now you have one reliable source for both hardware and software needs! The first packages available are:

NorthWord—
NorthWord is a simple-to-operate word processing system designed for use with the popular North Star HORIZON. NorthWord enables you to increase office efficiency and cut document typing time and cost. NorthWord incorporates the most sought-after word processing features: easy editing, on-screen text formatting, simultaneous document printing, and much more. NorthWord can be integrated with other North Star software packages to produce customized letters, labels and reports quickly and efficiently.

MailManager—
MailManager enables you to compile and maintain complete organized mailing lists. Lists are easily accessible and can be compiled with a great deal of flexibility. Entries, corrections and deletions are easily made. The North Star MailManager can print your list on individual envelopes, on mailing labels, or in compact summary form.

InfoManager—
InfoManager is a powerful list-oriented, data management system. It will accept up to 50 categories of information for each record and has the ability to select and sort before printing. The North Star InfoManager has power and flexibility for many applications: product inquiry, inventory, customer/client records, calendar reminders, and as an easy way to fill in often-used forms.

GeneralLedger—
General Ledger and Financial Reporting, two programs in one, maintains general ledger accounts based on such input as checks, bank deposits and journal entries, and uses the information in the general ledger to produce customized financial statements and financial reports.

NorthWord is the central building block for all the North Star application software to follow. Packages now being tested include other accounting and professional application packages. For more information or a demonstration, contact your local North Star dealer.

NorthStar
North Star Computers, Inc.
1440 Fourth Street
Berkeley, CA 94710
(415) 527-6950
TWX/Telex 910-366-7001



Text continued from page 24:

out that the I/O instructions bear a surprising resemblance to memory-reference instructions. The 6800 and 6502 microprocessors actually allocate a certain portion of their memory address space to be decoded and to function as I/O ports.

This technique, which can be used on the Z80 and 8080 just as easily, has certain advantages in speed and ease of use over direct I/O instructions. This technique is referred to as *memory-mapped I/O*. An illustration of the logic associated with this method is in figure 5. For a more rigorous analysis of memory-mapped I/O, I refer you to the November 1977 "Ciarcia's Circuit Cellar" article previously mentioned.

The final area for consideration is the actual transfer of data to and from the bidirectional data bus. The circuits of figure 4 and figure 5 tell only *when* the I/O operation occurs. Additional logic has to be provided to place data on the bus during an input instruction or to latch and hold the contents of the data bus during output instructions.

When the 8080 or Z80 assembly language instruction OUT (*N*),D is executed, the contents of the accumulator, D, are placed on the data bus and written into device *N*. The same is true for the BASIC-language instruction OUT *N*,D. The data is actually valid during only a few clock cycles, perhaps 500 ns. Making this data available for longer periods of time requires the addition of an 8-bit *latch*: the latch is made from a set of clocked flip-flops.

The output lines are attached to the data bus. When the proper output instruction is executed, signified by a strobe signal from our address and I/O WRITE decoder circuit as shown in figure 6, the contents of the data bus are transferred into the 8-bit register in synchronization with the processor clock signal. This combination of circuitry is commonly called an *8-bit latched parallel output port.*

External devices cannot be directly connected to the data bus for input, because of the possibility that interference and bus-loading problems will result. A three-state buffer is used as a *gate* to allow signals from the peripheral device to be placed onto the bus at the appropriate time.

During an input operation the process used for output is reversed. When the proper input sequence is executed, signified by the appropriate output from the address decoder and I/O READ decoder, the 8-bit three-state buffer is strobed into operation during the few clock cycles it takes for the processor to execute the input instruction. Logic levels present on the buffer input lines during that instant become impressed onto the data bus and are transferred into the accumulator. Figure 6 shows the logic elements that perform these functions.

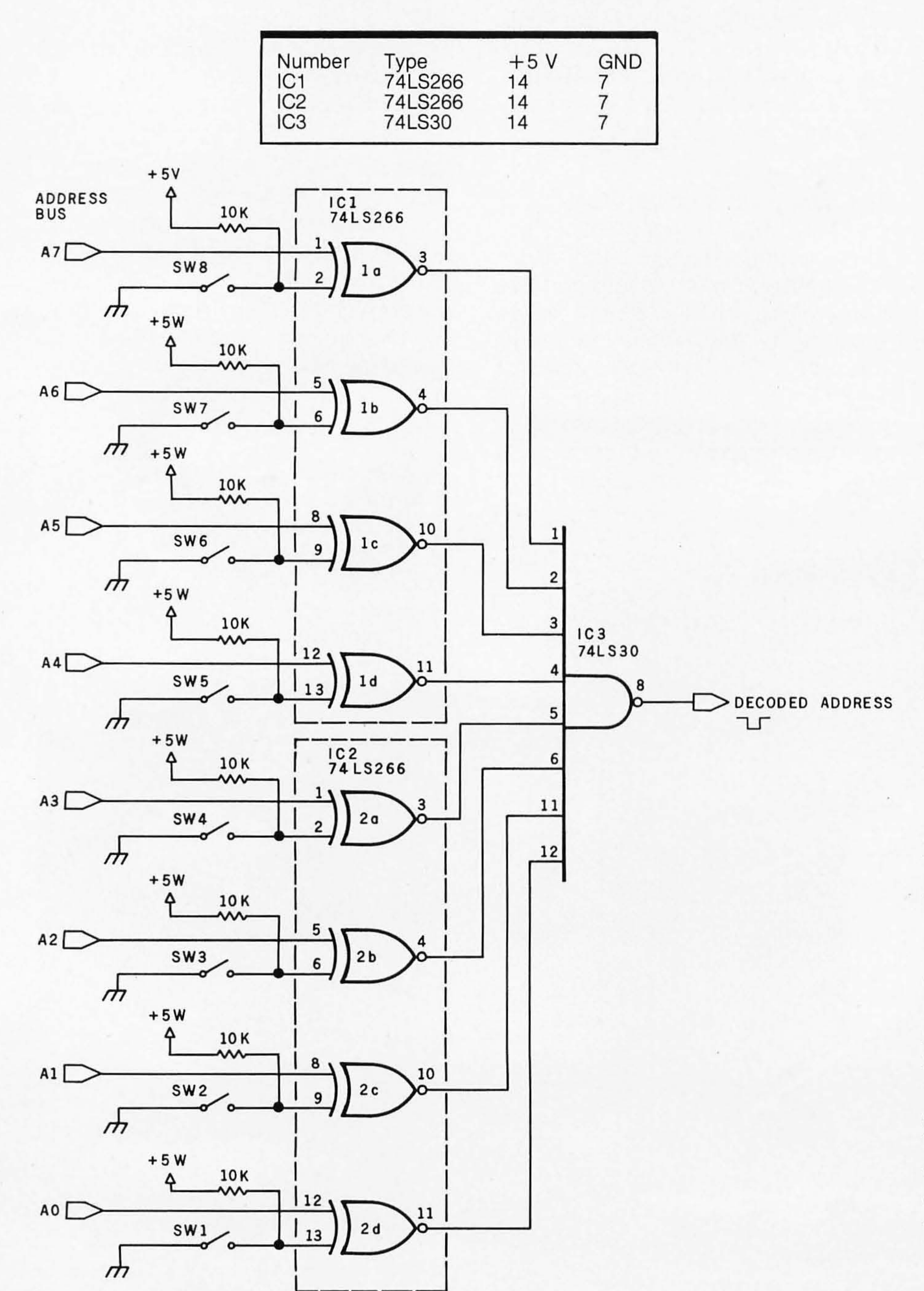


Figure 3c: *Another method of decoding an 8-bit address, using exclusive-NOR gates and an eight-input NAND gate. As in figure 3b, the desired port address is set up on switches SW8 thru SW1.*

Add Parallel I/O to Your TRS-80

I have been told that the TRS-80 Model I is currently the largest-selling personal computer. Unfortunately it

Text continued on page 38

Grrraphics.

The Paper Tiger™ puts more bite into everything you do.

The Paper Tiger strikes again. With a DotPlot™ graphics option that lets you make the most of your Apple II,† TRS 80,‡ or other personal computer.

With DotPlot and available software drivers, you can print screen graphics, draw illustrations, write block letters, plot charts. And DotPlot includes an expanded, 2K-byte buffer.

That's not all. Every Paper Tiger gives you 8 software-selectable character sizes. 80 and 132 column formats. Multi-part business forms handling. Forms control. Reliable stepper-motor paper drive. Adjustable width tractor feed. Continuous duty cycle operation. Plus lots more.

†Apple II is a trademark of Apple Computer Inc.
‡TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

The Paper Tiger costs only $995. The DotPlot option only $99 more. But don't let these low prices fool you. Because the Paper Tiger is rugged enough to stand up to the most demanding printer-plotter requirements.

For the name of the Paper Tiger dealer nearest you, call toll-free 1-800-343-6412 (except Massachusetts, Alaska, and Hawaii).

Integral Data Systems, 14 Tech Circle, Natick, MA 01760. (617) 237-7610.



Circle 15 on inquiry card.

Integral Data Systems, Inc.

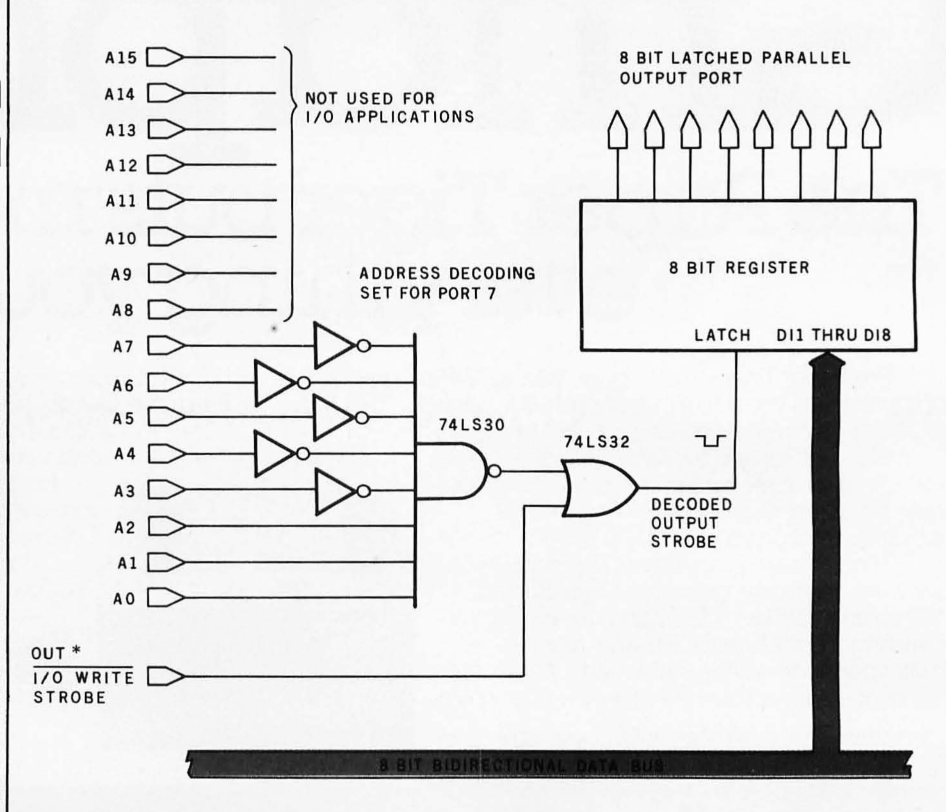


Figure 4a: *Block diagram of a typical parallel output port. The logic that decodes the 8-bit port address was shown in three forms in figure 3. The signal from the address-decoding circuit is logically combined with one of the control signals from figure 2 (I/O WRITE) to produce an output strobe signal that activates the 8-bit output latch register.*

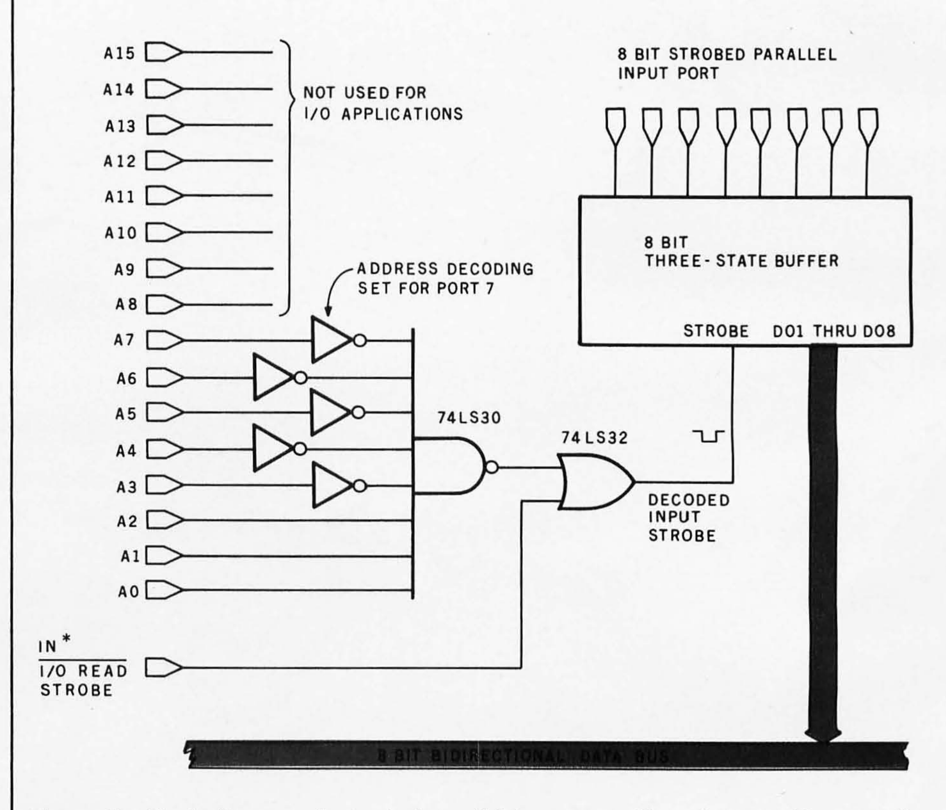


Figure 4b: *Block diagram of a typical parallel input port. Note the resemblance to the output port of figure 4a.*

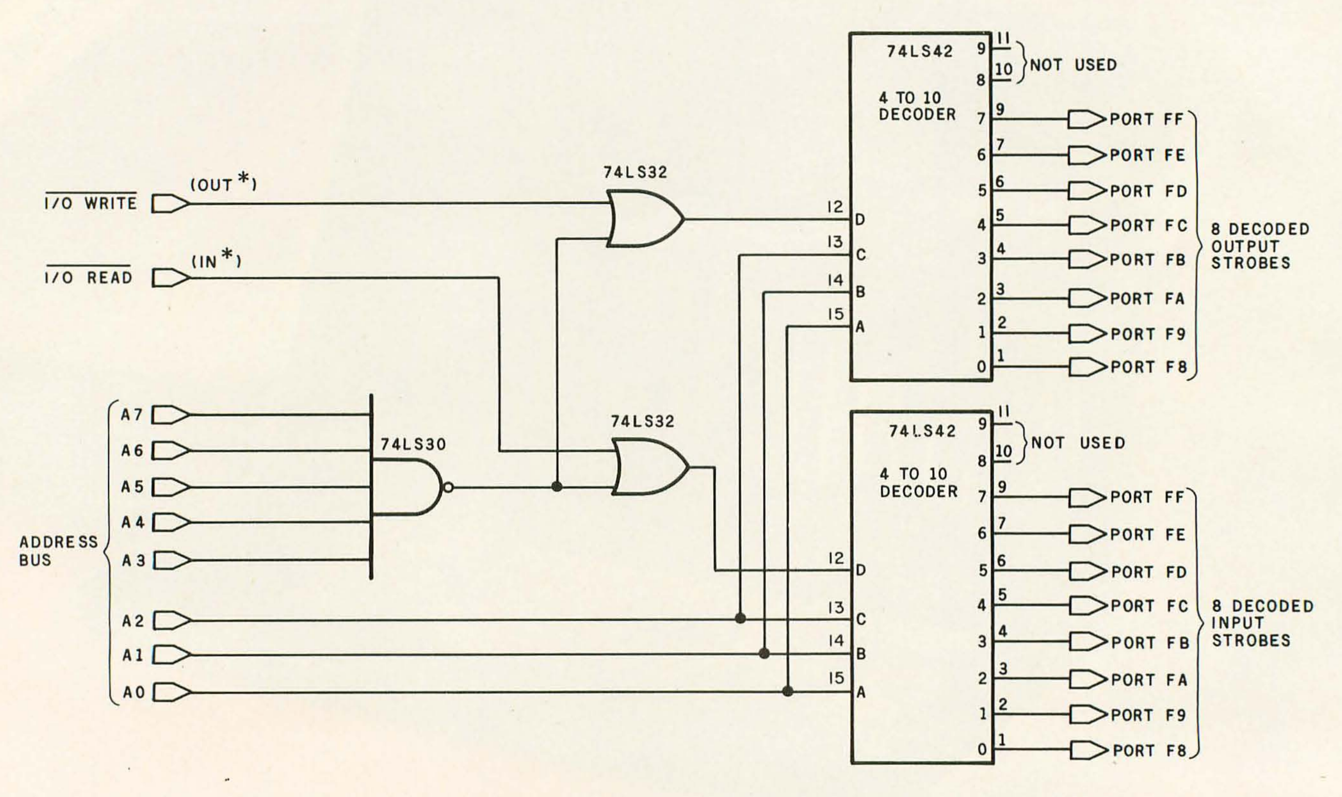


Figure 4c: *Schematic diagram of a circuit that produces eight decoded input-strobe signals and eight decoded output-strobe signals. The port addresses produced are hexadecimal F8 thru FF.*

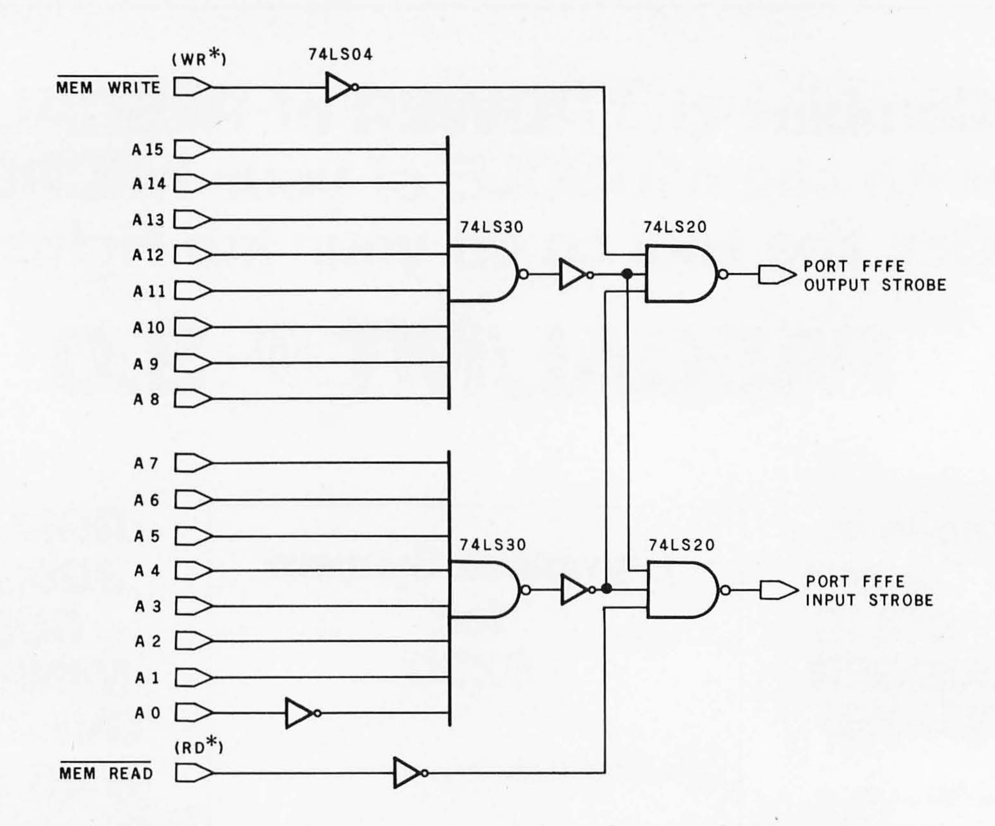


Figure 5: *Memory-mapped input and output. Some microprocessors do not have specific input and output instructions. In systems that use such microprocessors, the I/O port hardware is wired as a memory location; I/O operations take place using the memory-reference instructions (eg: load-into-accumulator and store-in-memory instructions) of the microprocessor. This type of addressing is called memory-mapped I/O, and all sixteen lines on the address bus must be decoded to perform an I/O operation.*

Number	Type	+5 V	GND
IC1	74LS377	20	10
IC2	74LS244	20	10
IC3	7404	14	7

LATCHED PARALLEL OUT
PARALLEL INPUT
B7 B6 B5 B4 B3 B2 B1 B0
IC3 7404
DECODED OUTPUT STROBE
IC1 74LS377
IC2 74LS244
DECODED INPUT STROBE
8 BIT REGISTER
8 BIT THREE-STATE BUFFER
DATA BUS
D7 D6 D5 D4 D3 D2 D1 D0

Figure 6: *Data connections in input and output ports. Once the proper port address has been decoded and combined with the read- or write-control signal to form an I/O strobe signal, the actual process of accessing the data bus for data transfer is relatively easy.*

For input to the accumulator (the most common pathway for I/O), a three-state buffer is used in conjunction with the decoded input-strobe signal that controls the enable line of the buffer.

For output from the accumulator, an 8-bit latch is connected to the data bus. During the execution of the output instruction, the contents of the data bus are clocked into the latch register and are latched there by the output-strobe signal.

Number	Type	+5 V	GND
IC1	74LS125	14	7
IC2	74LS125	14	7
IC3	74LS75	5	12
IC4	74LS75	5	12
IC5	74LS155	16	8
IC6	74LS04	14	7
IC7	74LS04	14	7
IC8	74LS30	14	7

Text continued from page 30:

is not configured to be easily interfaced to the projects I present each month. The widely sold Level II BASIC, 16 K-byte memory version has no parallel I/O capability, aside from the single-bit cassette-motor control. With the addition of the expansion interface, the user gets one parallel output port and one half (ie: 4 bits) of an input port. If these ports are used, as Radio Shack intends, to drive a printer, then the only way to provide usable parallel I/O capability is to add a separate I/O interface.

Considering the pertinent elements of the previous discussions, it is easy to construct both parallel input and

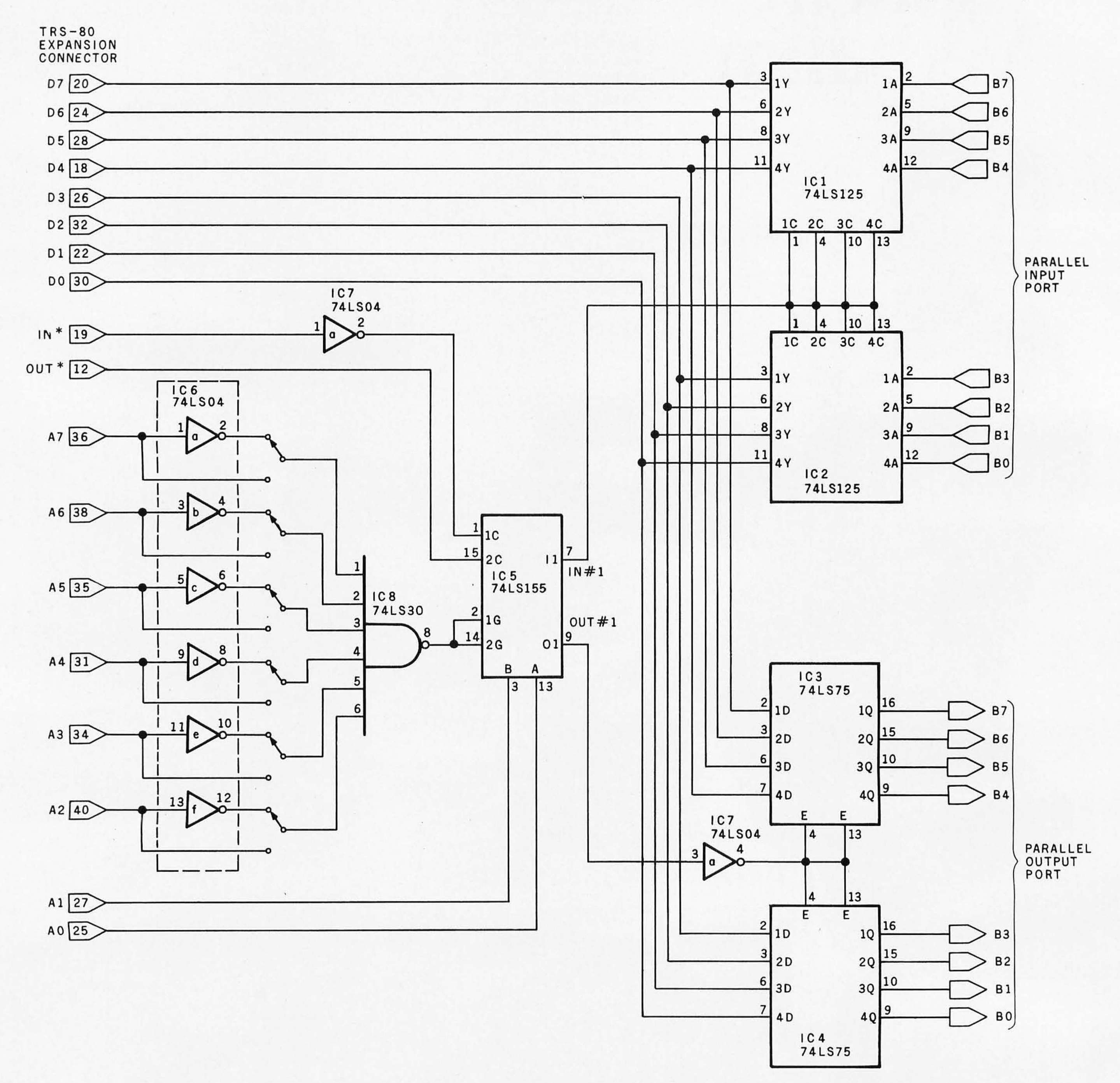


Figure 7: *A complete, economical, parallel I/O interface circuit for use with the Radio Shack TRS-80 computer, or with other computers that use a similar bidirectional data bus. This interface can be connected directly to the expansion connector at the rear of the TRS-80 keyboard/processor unit, or it can be connected through the expansion-interface unit. As the circuit is shown here, there are six presently undefined additional strobes available on IC5. These six strobes can be used to support three additional ports. Refer to figure 3 and figure 4 to determine the proper selection of the I/O port address for this interface.*

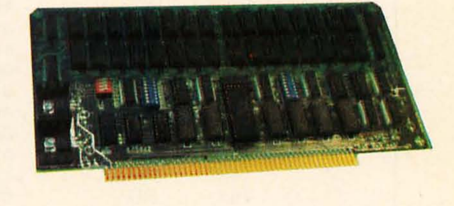


IEEE S-100 COMPATIBLE

There's a BIG + in every interface that QT manufactures. That's because every one of our products is an improvement over any other on the market. And every one is an S-100-based unit that meets the exacting IEEE standards.

Most items in our BIG + line are available as bare boards, a kit or a completely assembled and tested unit. What's more, we have the S-100 mainframe available for all our boards.

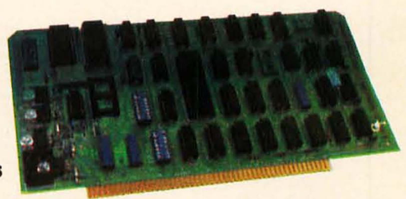
EXPANDABLE + DYNAMIC MEMORY (16K to 64K)



- + Works With Cromenco Systems
- + Uses 3242 Refresh Chip
- + 4 Layers Mean A Quiet Board
- + Bank Selectable Write Protect
- + Phantom Output Disable
- + Switch Selectable Output Disable

Bare Board	$ 49.95	32K Kit	$369.95	48K A&T	$494.95
16K Kit	$295.95	32K A&T	$419.95	64K Kit	$519.95
16K A&T	$345.95	48K Kit	$444.95	64K A&T	$569.95

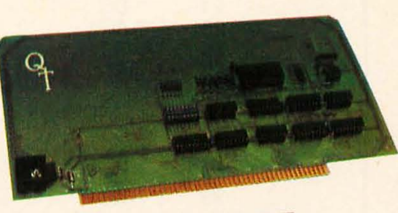
Z + 80 CPU



- + 1K Ram On Board + 2 Programmable Timers
- + Switch Selectable 2 or 4 MHZ
- + Power On Jump to On-Board 1K or 2K EPROM (2708-2716-2732) Can be Addressed on any 1K, 2K or 4K Boundary
- + Programmable Baud Rate Selection (110 to 9600)
- + On-Board EPROM May be Used in Shadow Mode, Allowing Full 64K RAM to be Used
- + On-Board USART for Synchronous or Asynchronous RS-232 Operation (On-Board Baud Rate Generator)

Bare Board	$ 45.00	A&T	$229.95
Kit	$169.95	1K Memory Kit	$ 12.00

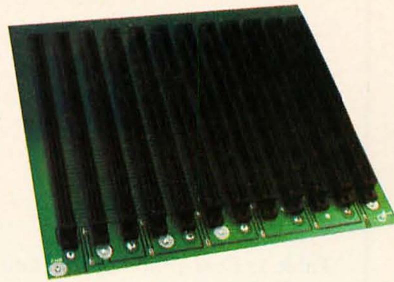
CLOCK CALENDAR +



- + Time of Day in Hours, Minutes and Seconds
- + 24 Hour Time Format
- + Month and Day Date Function
- + Simple Read Instructions Allow Simple Interface to Basic, CPM, Etc.
- + Will Run With 4 MHZ Processors
- + Can be Located at any Group of 4 I/O Port Addressed

Bare Board $45.00 Kit $99.95 A&T $149.95

SILENCE + MOTHER BOARDS



- + No Need for Termination
- + Very High Crosstalk Rejection
- + LED Power Indicator
- + Fits in Most Mainframes
- + 6, 12 and 18 Slots Available

6-SLOT		12-SLOT		18-SLOT	
Bare Board	$24.95	Bare Board	$39.95	Bare Board	$ 59.95
Kit	$49.95	Kit	$89.95	Kit	$129.95
A&T	$59.95	A&T	$99.95	A&T	$149.95

ASK FOR THE FOLLOWING NEW INTERFACES:

- I/O +
- Video +
- EPROM Programmer +
- Disk Controller +
- Modem +
- Mainframe +

Three of our newest dealers are:

DAL-COMP
2560 Electronic Lane
Suite 108
Dallas, TX 75220
214/350-6895

PRIORITY ONE (L.A. Area)
16723 Roscoe Blvd.
Sepulveda, CA 91343
213/894-8171
800/423-5633

SANTA ROSA
COMPUTER CENTER
604 7th Street
Santa Rosa, CA 95404
707/528-6480

Dealer Inquiries Invited



COMPUTER SYSTEMS INC.

"QUICK & TIMELY"

15335 South Hawthorne Boulevard
Lawndale, California 90260
(213) 970-0952,
800/421-5150 (Continental U.S. Only)





parallel output ports for the TRS-80. The interface shown in figure 7 provides one input and one output port. The signals necessary to drive this interface are available on the forty-pin expansion connector of the keyboard/processor unit or on connector J2 on the expansion interface. In either case, a separate +5 V supply is necessary to power the circuit. The signals on the expansion connector are listed in table 1, and the pinouts are shown in figure 8.

The schematic diagram of figure 7 shows a port address FF. To set another port address simply refer to figure 3 and 4 and place the switches for the proper code.

There are many other methods for implementing I/O capability. An 8255 programmable peripheral interface, a parallel I/O device, could have been used. The circuit I have chosen to present is intended to be inexpensive and easy to operate. By minimizing potential parts-acquisition problems and keeping down the software handshaking necessary when using large-scale circuits like the 8255, I hope to enable many TRS-80 owners to build the circuit and use it to attach other "Circuit Cellar" projects to their computer system.

I hope to enable many TRS-80 owners to build this I/O circuit and to use it to attach other "Circuit Cellar" projects to their computer systems.

Pin Number	Signal Name	Description
1	RAS*	row-address strobe output for 16-pin dynamic memories
2	SYSRES*	system-reset output, low during power-up initialization or when the reset switch is depresssed
3	CAS*	column-address strobe output for 16-pin dynamic memories
4	A10	address output
5	A12	address output
6	A13	address output
7	A15	address output
8	GND	signal ground
9	A11	address output
10	A14	address output
11	A8	address output
12	OUT*	peripheral-write strobe output
13	WR*	memory-write strobe output
14	INTAK*	interrupt-acknowledge output
15	RD*	memory-read strobe output
16	MUX	multiplexer control output for 16-pin dynamic memories
17	A9	address output
18	D4	bidirectional data bus
19	IN*	peripheral-read strobe output
20	D7	bidirectional data bus
21	INT*	interrupt input (maskable)
22	D1	bidirectional data bus
23	TEST*	placing a logic 0 on this line causes a high-impedance condition on address lines A0 thru A15, data lines D0 thru D7, WR*, RD*, IN*, OUT*, RAS*, CAS*, and MUX
24	D6	bidirectional data bus
25	A0	address output
26	D3	bidirectional data bus
27	A1	address output
28	D5	bidirectional data bus
29	GND	signal ground
30	D0	bidirectional data bus
31	A4	address bus
32	D2	bidirectional data bus
33	WAIT*	processor-wait input, to allow for slow memory
34	A3	address output
35	A5	address output
36	A7	address output
37	GND	signal ground
38	A6	address output
39	—	on Level I machines: low-current +5 V output on Level II machines: no connection
40	A2	address output

Table 1: *Description of function for the pins on the expansion port at the rear of the TRS-80 keyboard/processor unit. This pin assignment is also used in expansion slots in the expansion-interface unit. This information is provided through the courtesy of Radio Shack, a division of Tandy Corporation.*

1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40

Figure 8: *The configuration of output pins on the expansion port on the rear of the TRS-80 keyboard/processor unit. See table 1 for an explanation of the function of each pin.*

Those experimenters who hesitate to build hardware might want to purchase the entire communications interface. An assembled and tested unit, with power supply and containing a parallel port (for the Centronics printer) and a serial RS-232C-compatible interface, is available. The complete communications unit, called the COMM-80, will be presented in part 2 of this article and is available for $179.95 from:

MicroMint Inc
917 Midway
Woodmere NY 11598
Telephone (513) 374-6793

(New York residents please add applicable sales tax.)

Next Month

I shall complete the COMM-80 presentation by discussing the construction of a software-compatible RS-232C interface for the TRS-80 that has selectable data rates from 50 to 19200 bps. ■

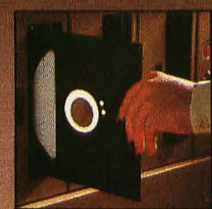
NOW CLEANING YOUR
COULD SAVE YOU A
AND A LO

The recording heads on your diskette drives may be filthy–and that can cause you a lot of grief. There's the serviceman you have to call when the machine doesn't perform. (You know how much service calls cost these days!) There's machine down-time. Idle data entry clerks. All the other delays a cranky machine can cause.

And that service call might not even be necessary.

3M SOLVES THE PROBLEM IN SECONDS– AND LEAVES YOUR HEADS "COMPUTER ROOM CLEAN".

The new Scotch® 7400 head-cleaning diskette kit lets *you* clean the read-write heads on your 8" or 5¼" diskette drives. In just 30 seconds, without any disassembly, mess or bother, the heads can be completely



cleansed of dirt, dust, magnetic oxides – all the things that can get into your machines every day. And foul them up.

Just saturate the special white cleaning pad in its jacket with the cleaning solution. Then insert the jacket into the diskette drive and turn it on. Your machine does the rest. The heads are microscopically cleaned without wear or abrasion.

This new 3M head-cleaning diskette kit has been evaluated and approved by major diskette drive manufacturers. It's the best possible way to clean your heads without service calls or machine teardowns.

AT ONLY $1 PER CLEANING IT'S THE BEST INSURANCE YOU CAN GET.

This fast-cleaning new Scotch kit comes with everything you need (including special fluid, applicator tip, cleaning diskettes) to handle up to 30 cleanings. That's only about a dollar a cleaning. Frankly, it's *outstanding* insurance.

Use the Scotch cleaning diskette

KIMDOS

Using Your KIM-1 with a Percom Floppy-Disk Drive

Joel Swank
4655 SW 142nd Apt 186
Beaverton OR 97005

Any owner of the MOS Technology KIM-1 knows the utility of the KIM's built-in audio-cassette interface. But, any KIM-1 owner who has expanded his system knows just as well how inappropriate the cassette is for storing long files. The standard KIM cassette format is intolerably slow, and even using the Hypertape method (a faster cassette-storage format for the KIM), a 4 K-byte file takes a minute and a half to load, not counting the time needed to position the tape.

The natural storage alternative is, of course, the floppy disk. However, there are some difficulties. A floppy-disk system requires a considerable amount of software to make it useful. In addition, many floppy-disk systems available today come with proprietary software for the 8080/Z80 or 6800 processors. Interfacing such systems to a KIM-1 requires the hobbyist to write his or her own 6502 software, working from the machine code for the other processor. While it is possible to do this, few hobbyists are willing to translate machine code to get their disk system up and running.

I decided to interface a Percom LFD-400 disk system to my KIM-1. The LFD-400 system contains a disk controller capable of controlling up to three 5-inch floppy-disk drives. It comes with complete, annotated source code for the 1 K-byte MINIDOS disk-operating system, written for the 6800 processor. MINIDOS allows the reading and writing of contiguous memory files, and is the nucleus of MINIDOS-PLUSX, a 6800-based disk-operating system sold by Percom.

KIMDOS is a KIM-1-compatible version of the Percom MINIDOS. It allows a KIM-1 to read and write files that are compatible with the Percom format. This article will concentrate on explaining the workings of the KIMDOS software. The LFD-400 system easily interfaces to the bus lines of any KIM-1 system (see table 1); because of this, hardware interfacing will not be discussed here.

The LFD-400 uses hard-sectored disks with ten 256-byte sectors per track and thirty-five tracks per disk. This gives 87.5 K bytes of usable data per disk. The controller board has sockets for up to 3 K bytes of 2708-type erasable programmable read-only memory (EPROM). KIMDOS has been written to fit in one 2708 device.

The controller board requires unregulated power supplies of +14 V, −14 V, and +8 V; or regulated power supplies of +12 V, −5 V, and +5 V. The controller is



Photo 1: *The author's personal computer system. It contains the following commercially built equipment: a MOS Technology KIM-1 microcomputer, three 8 K-byte Digital Group static memory boards, a Percom LFD-400 floppy-disk controller and two Shugart 5-inch floppy-disk drives, a Southwest Technical Products Corporation GT-6144 graphics board, an ACT-IA terminal with Leedex monitor, an Olivetti TE-300 hard-copy terminal, and several Lambda power supplies. Homebrew equipment in the system includes a programmer for erasable programmable read-only memories (EPROMs), a programmable integrated-circuit tester, a calculator interface, the motherboard, and the input/output (I/O) interface board.*

Photograph taken by John M Hannam.

Chief Relief

For years many small business system buyers thought that in order to get "real" performance and enough storage to be a "real" business system they would have to sacrifice the family jewels.

But with the introduction of the Smoke Signal Chieftain series office computers a lot of people's minds have been changed.

Because we designed the highly reliable Chieftain small business system with the most innovative combination of performance and efficiency around.

At your fingertips there are 64,000 characters of random access memory and you can address anywhere from 740,000 characters to 2 million characters with Smoke Signals's new double density controller. For larger concerns, there's a 20M byte hard disk available.

At a time when other small computer manufacturers tell you "you're on your own", Smoke Signal offers an abundance of easy-to-use software programs such as order entry, inventory control, accounts receivable, invoice entry, payroll, word processing and much, much more. There's BASIC, COBOL and FORTRAN — even a multi-user BOS (Business Operating System) that allows for numerous users simultaneously.



Chieftain systems starting at under $200.00 per month display performance on par with systems costing twice to three times as much.

So call (213) 889-9340 for your nearest authorized Smoke Signal dealer — he'll be glad to demonstrate the Chieftain's high reliability and ease of operation.

For dealers only, circle 25
All other inquiries, circle 24

SMOKE SIGNAL BROADCASTING

31336 Via Colinas, Westlake Village, California 91361, (213) 889-9340

composed of twenty-seven transistor-transistor logic (TTL) integrated circuits and the Z5023 universal synchronous receiver/transmitter (USRT) on a 15.24 by 25.4 cm (6 by 10 inch) two-sided printed-circuit board. Low-power Schottky (LS) components are used to reduce power consumption and minimize bus loading.

Floppy-Disk Drive

The Shugart 5-inch floppy-disk drive comes assembled and tested from Percom. A copy of the Shugart instruction manual is included in the system documentation; it is thirty-three pages long, and contains schematic diagrams and complete specifications for the drive and its operating principles. Trouble-shooting procedures are also detailed.

Each disk drive must be set up to respond to a specific drive number. This programming is accomplished by plugging a shunt block into a fourteen-pin dual-in-line pin (DIP) socket. A seven-pole DIP switch can replace the shunt block; the drive numbers may be easily changed using the switch.

Because the Shugart floppy-disk drive allows only three drive-select lines, the controller board in the Percom LFD-400 system uses only the drive-select lines that are numbered 01 thru 03. A drive-select line for device 00 exists, and can be selected by the KIMDOS software; however, this line is not usually connected to anything. With the addition of the proper jumpers to the controller and disk-drive boards, a four-drive disk system can be configured using device numbers 00 thru 03. The Micropolis disk drive could be used for this purpose, since it has a fourth drive-select line on pin 34 of the thirty-four-pin ribbon cable.

Functions of the Controller

The LFD-400 uses a crystal oscillator to time the data and clock bits from the drive. The data is separated from the clock bits and is shifted into the universal synchronous receiver/transmitter. The USRT latches each 8-bit byte and sets a flag to notify the processor to read the byte. For a write operation, the USRT sets a flag when it is ready to receive data from the processor. After the processor has stored the data in the USRT, the data is shifted out, merged with the clock bits, and is sent to the drive.

LFD-400	KIM Connector	Function	Comments
9	E-7	RST	
10	E-V	R/W	
11	E-22	VMA	VMA always true on KIM-1
12	E-U	ϕ_2	
19		+14 V	or use regulated +12 V
20		−14 V	or use regulated −5 V
21		+8 V	or use regulated +5 V
22		+8 V	
23		+8 V	
24	E-22	ground	
25		ground	
26		ground	
27	E-A	A0	
28	E-B	A1	
29	E-C	A2	
30	E-D	A3	
31	E-E	A4	
32	E-F	A5	
33	E-H	A6	
34	E-J	A7	
35	E-K	A8	
36	E-L	A9	
37	E-M	A10	
38	E-N	A11	
39	E-P	A12	
40	E-R	A13	
41	E-S	A14	
42	E-T	A15	
43	E-8	D7	
44	E-9	D6	
45	E-10	D5	
46	E-11	D4	
47	E-12	D3	
48	E-13	D2	
49	E-14	D1	
50	E-15	D0	

Table 1: *Hardware connections from the KIM-1 single-board computer to the Percom LFD-400 disk-drive controller. Also given is the function of each line used.*

The controller also takes care of maintaining the current sector count. The motor-control circuit contains a monostable multivibrator (commonly called a one-shot) that turns the motor off after about 3 seconds of nonuse. The drive select is a 2-bit number that is latched and decoded to select one of three drive-select lines, as discussed previously. The drive-select line for device 00 is not used. The step and direction bits are also latched. The track-0 and the write-protect lines are buffered for the microprocessor. Address decoding is provided for all controller addresses and for the 2708s. The data bus is buffered with 8835 three-state buffer devices.

Hardware Modifications

The only incompatibility between the KIM-1 and the LFD-400 lies with the use of a "low-true" logic convention on the SS-50 data bus. In the low-true convention, a voltage potential of 0.4 V or less is regarded as a true or binary 1 logic signal. This convention is used because the 8835 devices are *inverting* buffers.

The KIM-1 uses a high-true convention on its data bus; potentials of 3.5 V or greater are regarded as a true or binary 1 logic condition. To remedy this problem, I replaced the 8835 buffers with their noninverting counterparts, 8833 buffers. Since the disk-controller board does not have sockets, the 8835s had to be unsoldered. An alternative method would have been to write software that accepts and translates the inverted data coming from the controller, but the software method seemed more difficult and error-prone than the hardware method of replacing the three-state buffers.

My KIM-1 system has regulated voltage sources of +5 V, −12 V, and +12 V. I chose to bypass the

Circle 47 on inquiry card.

LFD-400 regulators for +5 V and +12 V and drive the circuits that require these voltages directly from the system power supply. I fed the −12 V source into the −5 V regulator on the LFD-400 to obtain that regulated voltage.

The only other modification required was due to a problem with the oscillator circuit, which did not always start when the system was powered up. To correct this, I short-circuited the 0.001 μF capacitor near the crystal, effectively removing it from the circuit. According to the engineers at Percom Data Corporation, no one else has reported this problem.

There are five ten-pin Molex connectors on the controller board. Mates for these are available from Percom; however, it may be more convenient to simply remove the Molex connectors and replace them with another type. The pin numbers on the controller board and the KIM-1 equivalents are given in table 1.

2a

Hexadecimal Address	Function When Used as Input
CC00	Read USRT status: bit 0 = 1 means disk unit ready to send byte to computer at address CC01 during read operation bit 7 = 1 means disk unit ready to receive byte from computer at address CC01 during write operation
CC01	Address used to transmit data from disk drive to computer during read operation
CC02	During read operation, bits 0 thru 3 contain current sector number in binary
CC03	Drive status byte : see table 2b.
CC04	Accessing this location with a load instruction (LDA) causes a read operation to take place

2b

Bit	Value	Meaning
0	1	Write-protect notch in disk covered; disk is protected
1	1	Head is at track 0
2	0	Drive motor is on
3	0	Drive circuit is ready to write to disk
4	1	Sector pulse; drive detects sector hole
5	1	Index pulse; drive detects special index hole
6,7		Binary number of drive selected (01 thru 03)

2c

Hexadecimal Address	Function When Used as Output
CC00	Defines value that controller will recognize as the SYNC byte at the beginning of a read operation; hexadecimal FB used in Percom format
CC01	Address used to transmit data from computer to disk unit during write operation
CC02	Defines value that controller will recognize as the filler byte (written after trailer until disk motor turns off); hexadecimal FF used in this software
CC03	Data to select drive and head-movement direction: bit 4 = direction of head movement: 1 = in, 0 = out bit 5 = step pulse bit; causes data-transfer head to jump to next track in direction given by bit 4 bits 6, 7 = binary number of drive to be selected
CC04	Accessing this location with a store instruction (STA) causes a write operation to take place
CC05	Accessing this location with either a load (LDA) or store instruction causes a motor-on pulse to be sent to the disk drive
CC06	Accessing this location with either a load or store instruction causes a motor-off pulse to be sent to the disk drive

Table 2: *Memory addresses used by the LFD-400 disk-controller board. Communication takes place between the disk and the computer via memory-mapped bytes as listed. Table 2a gives the function of 5 bytes used for input from disk to computer. Table 2b defines the permissible values of bits in the drive-status byte (hexadecimal location CC03). Table 2c gives the function of 7 bytes used to control output from the computer to the disk.*

Software and Hardware Interaction

All communication between the microprocessor and the disk controller takes place through hexadecimal memory addresses CC00 thru CC06. Because address lines A4 thru A9 are not decoded, addresses as low as hexadecimal CC10 to CC16 and as high as hexadecimal CFF0 to CFF6 also respond identically; but these addresses are not used. A complete list of controller addresses and functions is found in table 2.

The data on each floppy disk is arranged in thirty-five *tracks* or concentric circles. The motor rotates the disk at 300 rpm — one rotation takes 200 ms. Each track is divided into ten sectors in this hard-sectoring scheme.

In *hard sectoring*, the sector boundaries are detected by means of physical holes punched through the recording surface of the disk. As the disk rotates, these holes pass between a light-emitting diode (LED) and a photoelectric detector. Percom floppy disks have ten sector holes evenly spaced around the hub hole of the disk, with a single additional *index hole* placed halfway between two of the sector holes. This index hole is used to identify one sector on the disk as sector 0. Timing circuits in the controller detect the shorter distance between holes when the index hole passes the photodetector. When the index hole is detected by this method, the sector counter is reset.

Each sector occupies one tenth of the circumference of a track on the disk and passes across the disk data-transfer head in 20 ms. Data is written to the disk at a rate of 1 byte every 64 μs, theoretically giving room for up to 312 bytes per sector. It is not possible to fully use these 312 bytes. The Percom format uses a maximum of 287 bytes for leader, header, useful data, and trailer, with the data length variable from 1 to 256 bytes. Table 3 details the format of data stored in each sector.

Each track on the disk has ten sectors. The sectors are numbered in decimal from 000 to 349. In this three-digit numeral, the two high-order digits denote the track number in

The Missing Link

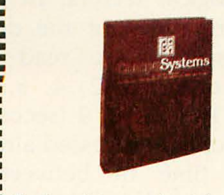


WORD PROCESSING QUALITY OUTPUT

for the Apple II is now affordable with IBM's Electronic Typewriters - Models ET50 (proportionally spaced), 60, and 75. Our "Missing Link" plugs directly into Apple's I/O BUS and to the IBM electronics. It's fully isolated; uses no solenoids, linkages, baseplates, etc; does not affect normal typewriter operation; does not void IBM's warranty or the availability of an IBM maintenance contract. The intelligence on the card handles everything totally "transparent" to the user. (No peeks, pokes, etc.) IBM's attractive purchase plans on these sophisticated typewriters further reduce the barrier to Apple II Word Processing. The ET50 and 60 are currently priced at $1,590, leasing at $85 per month, and several time pay plans are available. Check with your local IBM sales representative for exact prices.

WORD PROCESSING QUALITY INPUT

for Wycliffe Bible Translators (a 3500 member missionary organization which has already translated the New testament into over 100 languages) was the major design criteria in the development of the **PTP** (Programmable Text Processor) language and **Manuscripter** word processing program. Since their conception in 1976, **PTP** and **MANUSCRIPTER** have evolved within Wycliffe and are now working on 8080, Z80, and PDP11 computers. The newest 6502 version for the Apple II incorporates all of the sophistication and ease of use gained by this experience. (All the normal features as well as "virtual" disk storage, merging of names and addresses, assembling new text automatically from a paragraph library, conditional hyphenation, global search and replace, and much much more). The 130 page manual offered below describes **all** the features.



To locate your nearest dealer or to place your order:
CALL TOLL FREE 1-800-854-2003 ext. 895
IN CALIF. CALL 1-800-522-1500 ext. 895

- ☐ MISSING LINK @ $225.00
- ☐ Missing Link Technical Manual @ $2.50*
- ☐ Manuscripter Word Processing Program @ $195.00
- ☐ Manuscripter Manual @ $9.95*

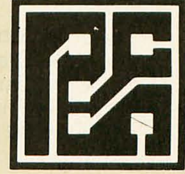
*Fully credited toward purchase

Enclosed is my check for ______ Bill VISA ☐ Bill Master Charge ☐
Card # ______ Exp. Date ______
Signature ______ Name ______
Street Address ______
City ______ State ______ Zip ______ Phone ______

WE DON'T PLAY BINGO:

Our industry is blessed with fantastic interest but plagued by many who circle "Bingo" numbers purely for their entertainment value. Obviously the cost of all this **free** literature is ultimately paid by those who **actually buy** the products. If you're genuinely interested in our products we feel you'll appreciate paying only for the literature and manuals **you** receive.





P.O. BOX 5144 • 2301 DEVINE ST. • COLUMBIA, S.C. 29205 • (803) 254-0804

which the sector is located. The low-order digit specifies the sector within the track. When we prefix this three-digit numeral with the number of the disk drive, we obtain the *external* drive/track/sector (DTS) number, a four-digit quantity which is stored in binary-coded-decimal (BCD) form in 2 bytes.

For use in actual disk-addressing operations, the external DTS number is reformatted into a binary, *internal* drive/track/sector number. The internal DTS number has the following properties. The number of the disk drive (1 thru 3) is stored in binary form in the 2 high-order bits of the first byte of the internal DTS number. The track number (1 thru 34) is stored in the 6 low-order bits of the first byte. The individual sector number (1 thru 9) is stored in binary form in the second byte.

Field Name	Length in Bytes	Contents
Leader	16	Binary zeros
Sync	1	Hexadecimal FB to indicate start of data
Current DTS number	2	Drive/Track/Sector numbers of this sector
Backward link	2	DTS number of previous sector in file
Forward link	2	DTS number of next sector in file
Byte count	1	Length of data in this sector, in hexadecimal (00 means hexadecimal 100)
Target address	2	Address of memory from which data was written
File type	1	Indicator of the nature of the data
Data	1 to 256	Data being stored
Check sum	2	2-byte cyclic redundancy check sum of all bytes after sync byte
Trailer	2	DTS number of first sector of this file, or execution address if this is last sector in this file

Table 3: *Table of sector fields and format. The drive/track/sector (DTS) number, stored here in internal binary format, points to a given sector.*

While the reformatting of the drive and track numbers from external to internal format involves only a simple decimal-to-binary conversion, the reformatting of the sector number employs a technique called *alternating-sector addressing.*

Why is alternating-sector addressing necessary? The sectors of the spinning disk pass under the read/write head consecutively, and there is no time between sectors during which the disk-operating system can perform housekeeping functions. While KIMDOS is performing the housekeeping routines for one sector, the next sector is already passing the head. Since housekeeping and sector reading cannot take place simultaneously, reading the sectors in sequential order would require the computer to wait for a full rotation of the disk to occur to read the sector that passed the head during housekeeping. Since every sector must be treated this way, only one sector could be read during each rotation of the disk if sectors were to be read sequentially. To remedy this problem, the sequential sector numbers are converted into alternating sector numbers.

KIMDOS reads or writes alternate sectors on the disk; the disk must rotate twice for all sectors on the track to be read or written. The order of physical sectors is therefore not the order of logical sectors. In the two complete rotations of the disk, the physical sectors are read in the following order: 0, 2, 4, 6, 8 (first rotation); 1, 3, 5, 7, 9 (second rotation). Sectors are accessed alternately to allow time in between data-transfer operations for executing housekeeping routines.

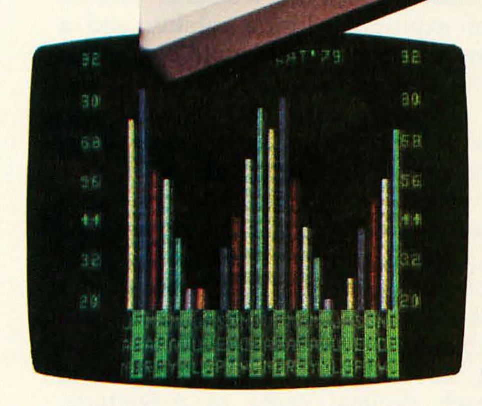
Each sector contains a *sector header* that holds information about the sector and the file of which it is a part. The first two bytes of the sector header contain the DTS number of the current sector; this is used to assure proper head position when reading. Each sector is linked via a forward pointer to the next sector and via a backward pointer to the previous sector. A forward pointer equal to 0 indicates the last sector in a file; a backward pointer equal to 0 indicates the first sector in a file.

The header also contains a data-length byte, a file-type byte, and the

Text continued on page 158

The Imagination Machine™

The only computer with color, sound, user programmability and expandability at $599.



The Imagination Machine offers more at its price than any other personal computer on the market today.

Consider these features: 9K RAM, with 14K BASIC in ROM,53-key typewriter keyboard. A fine resolution picture, generated on your television set or monitor in 8 colors!

A built-in, dual-track cassette tape deck with 1500 baud rate, for APF's digitally recorded, "saturated," tape programs. A built-in sound synthesizer. And two, built-in, game style controllers, with joysticks and numeric keypads.

When you want to go beyond APF's library of educational, home-and-personal management or entertainment programs . . . when you want to create your own programs . . . you can. The Imagination Machine is programmable in BASIC and 6800 machine language. The Imagination Machine is also expandable. Just add our "Building Block", an optional, four-port expansion device, and you can hook up a printer, telephone modem, and additional memory cartridge or mini-floppy disk drive.

For the name of your nearest Imagination Machine dealer call, TOLL FREE: 1-800-223-1264. (New York residents call: (212) 758-7550) or write: APF Electronics, Inc. 444 Madison Avenue, N.Y., N.Y. 10022.

$599. Manufacturer's suggested retail price.

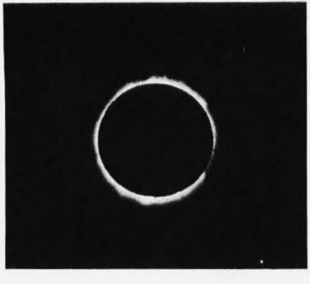
APF electronics inc.

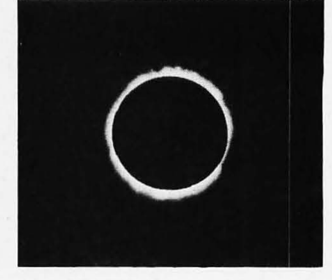
"YOUR LIFE WILL NEVER BE THE SAME!"

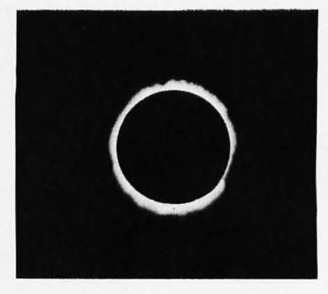
See us at NCC, Booth 85




(3a) 1 millisecond


(3b) 2 milliseconds


(3c) 5 milliseconds


(3d) 10 milliseconds

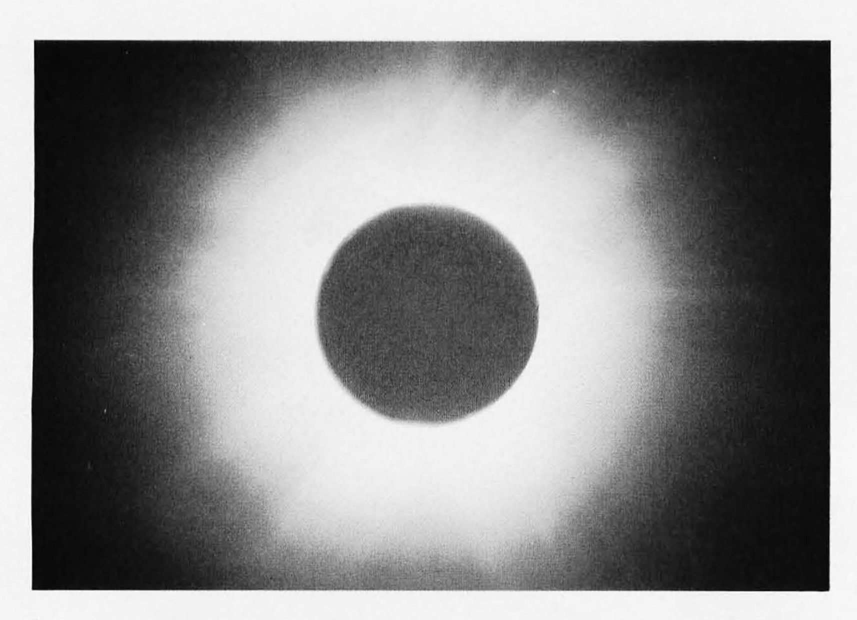


Photo 1: *A 5-second exposure with ASA 64 Ektachrome brings out significant coronal detail twice per 25-exposure cycle.*

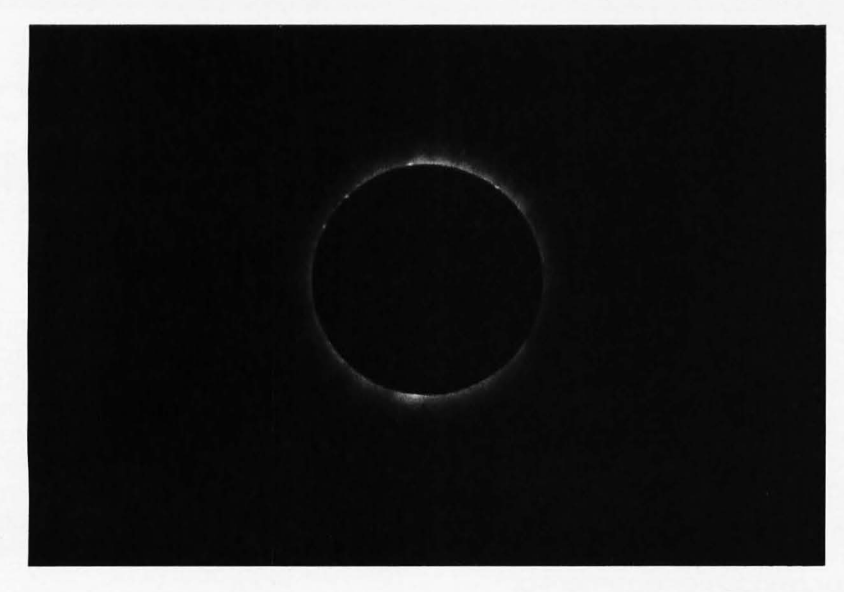


Photo 2: *A minimal length exposure shows the beginnings of some prominence detail and the inner corona. This exposure corresponds to the shortest nominal exposure time, 1 ms plus the minimum trigger-pulse width of 20 ms. The electromechanical system which is the Nikon MD-2 Motor Drive unfortunately has a minimum shutter-open time on the order of 20 ms. Thus the exposures nominally programmed at 1, 2, 5, and 10 ms were actually on the order of 21, 22, 25, and 30 ms.*

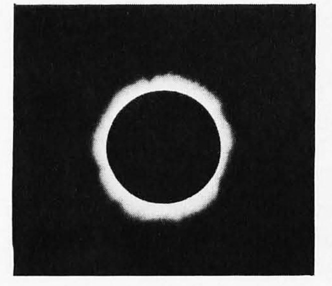
Text continued from page 6:

With this crucial timing step completed, I turned my attention to refining the Pascal program shown as listing 1 in the March 1980 BYTE editorial. These refinements included one conceptual change and some trivial changes in the experiment's design.

The conceptual change was that of adding a single long exposure made during the "slack time" interval at the end of the eclipse sequence during totality. As noted earlier, the model for the eclipse photography sequence used two manual inputs: one to start a sequence of diamond-ring exposures followed by automatic totality photography, and a second manual input to start the final diamond-ring sequence after a "slack time" for synchronization. My conceptual change was to open the shutter of the camera during this slack time, thus allowing one extremely long exposure to take place while waiting for the second manual input. Thus by specifying a smaller number of exposures during totality and a longer slack time, I would obtain this one long exposure.

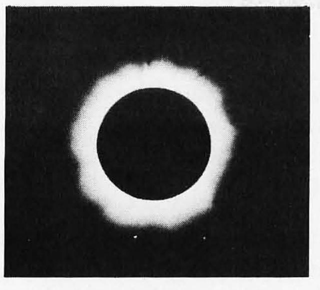
The relatively trivial changes began with the alteration of the table of exposure times to provide a total of twenty-five different times instead of ten. In making this change I used the UCSD text editor to change the name of the table in every occurrence throughout the program. I also changed the initialization to provide a 1, 2, 5 sequence of exposure times in each decimal order of magnitude. (See photo 3's captions for the values resulting.)

Another relatively minor change was to allow multiple tries at allocation of the exposures, rather than falling inexorably into a run of the photography sequence. This change proved quite useful in the field where it provided a means of verifying that

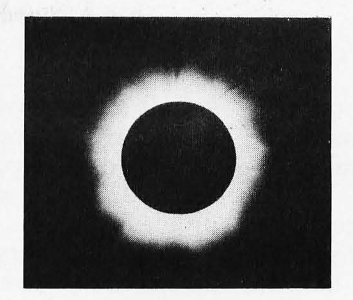


(3e) 20 milliseconds

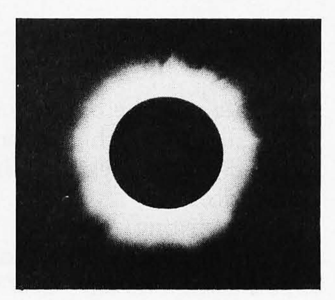




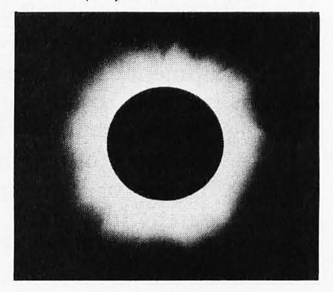
(3f) 50 milliseconds



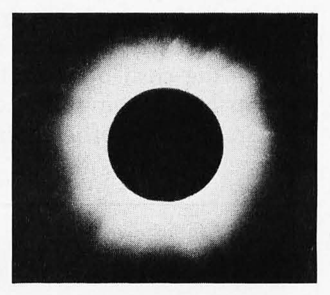
(3g) 0.1 second



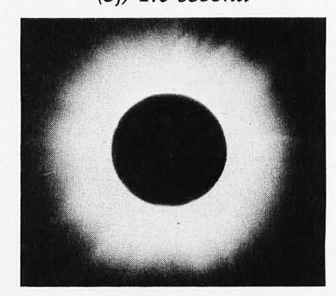
(3h) 0.2 second



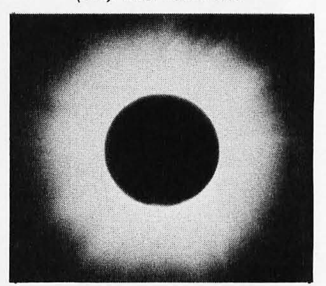
(3i) 0.5 second



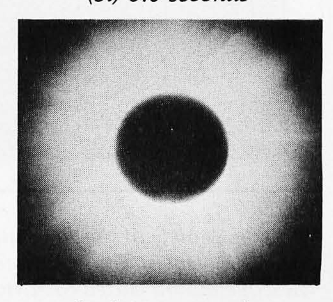
(3j) 1.0 second



(3k) 2.0 seconds



(3l) 5.0 seconds



(3m) 10.0 seconds

Photo 3: *Black and white reproductions of the entire series of different exposures taken with the aid of the final version of the Pascal control program for the camera. Times are nominal shutter-open intervals stored in a table in the program. Actual times reflect a fixed lower-limit overhead of approximately 20 ms.*

the computer had not died in the last minutes prior to totality. The program also had to be modified to talk to a 40-character-wide field on the Apple II video display instead of the 80-character width available on the terminal I normally use. This change amounted to condensation of the texts displayed during the allocation procedures. The final form of the program as used by the shores of Lake Jipe on February 16, 1980 is shown in listing 1.

The final equipment check prior to leaving was the verification that the display on a 2-inch diagonal Sanyo television screen was adequate. A jumper cord once used to interface between a tape recorder and my old homebrew computer provided the means for routing the output of the Apple's auxiliary RF modulator to the Sanyo television. The display wavered a bit when running on the portable generator. It was a tiny display but adequately readable for my purposes.

After this crucial experiment, the final detail was to make redundant copies of my eclipse application program's disk, as well as the UCSD Apple Pascal system's disks Apple1, Apple2, and Apple3. Redundancy was important. If I were to have a directory crash due to dust or dirt while on the other side of the equator 11,000 miles from home, a second chance would have been well worth it.

On Tuesday morning February 5, we hastened to Boston where the air travel to Kenya began with a trip to New York's Kennedy Airport. The party at this time consisted of myself, Tully Londoner, Norm Whyte, and Laurel Allen. Rick Lutman, the fifth member of our party, would join us in Nairobi. In due course we boarded Pan American's flight 190, an 18-hour international puddle jumper with stops at Roberts Field, Liberia, and Lagos, Nigeria. The computer equipment and telescope mount in addition to trunks and pack frames full of clothes, sleeping bags, and tools constituted our luggage.

On reaching Nairobi at about 8 PM that Wednesday, we met our guide, Iain Allan, and his associate Vince Fayad. Iain does business as Tropical Ice (Mountain Guides) Ltd, Post Office Box 57341, Nairobi, Kenya. Making the connection with Iain was the only redeeming virtue of an otherwise hopelessly botched set of travel arrangements made by our US travel agents (who shall remain anonymous). Iain was our guide to the wilds of Kenyan culture for the next two weeks. His good humor and knowledge of local flora, fauna, and climate are highly recommended to anyone traveling in East Africa for purposes of game trekking or technical mountain climbing. Iain wrote the guidebook on Mt Kenya and other climbs in Kenya. He also frequently guides technical climbing trips on Tanzania's Kilimanjaro, when not tackling various other challenging rock climbs in places as diverse as Nepal and Yosemite.

As in any trip of this kind, there were some difficulties. The most significant (and in retrospect, completely avoidable) difficulty was the need to post a 30,000 shilling bond on our equipment with Kenyan customs on entry. We later had to recover our customs bond on departure (minus an exorbitant 10% fee exacted by the local branch of a major US multinational bank). The fact that we had to post a bond at all was due to an un-

fortunate mistake by one of our party, a slipup which can possibly be avoided by readers in similar circumstances.

When listing personal computer equipment being carried for such an expedition, never ever list its monetary value or speak of its value. To satisfy US customs, all you need is a list of serial numbers of your personal equipment carried abroad. This list can be used to advantage when entering another country. But if you give the customs officer at another country the list of items and values you prepared for your insurance agent, it is like waving a red flag in front of a bull.

We had to post a customs bond on Norm's equipment using credit cards to obtain nearly $4000 in cash, then retrieve the cash bond at the end of the trip by pleading lack of time to Kenyan customs officials in order to get all the paperwork completed by our departure. We wasted two out of sixteen days figuring out all the "catch-22"-style sophistries of this problem.

Kenya is a very British relic of a former era, where dual languages of Swahili and English dominate. Iain pointed out that it would have been much more complicated in several countries in which he has traveled for purposes of mountain climbing. In one Asian country he has visited for climbing, Iain points out, there is not even a recognizable set of paperwork to be filled out. It was quite a relief to get back to a (relatively) sane United States at the end of the trip.

So much for the bureaucratic problems of taking computers abroad to equatorial Africa. What about the engineering problems? We did as thorough a job of preparation as we could, yet would the computers and generator still play together when we reached our final encampment on the shores of Lake Jipe in Kenya's Tsavo West National Park?

We answered this question by an ancient technique: crossing fingers and applying power. We arrived at Lake Jipe 2 days before the eclipse, after a 6-hour trek over some incredible roads in Iain's Volkswagen bus with trailer in tow. The computers were inside the bus with seven human bodies and food packed with solid CO_2 in the famous Tropical Ice Box. All the rest of our gear was carried in the trailer. The roads we traveled from Amboseli to Lake Jipe included one 5-mile stretch of a semi-improved lava flow, an unmarked dead end which looked like the main road of two alternatives, and other miscellaneous "hazards" like herds of elephants and troops of baboons.

The day before the eclipse, Norm



Photo 4: *A view of the equipment set up at the Tsavo West National Park campsite on the shores of Lake Jipe. Norm was using a 500 mm reflex lens with his camera; I was using my 1000 mm reflex lens. The two Nikon cameras were mounted on the equatorial telescope mount carted to Africa along with the 110 VAC generator in Norm's homebrew plywood shipping trunk. The Apple Pascal system is shown sitting in the bottom of its carrying case on top of a trunk.*

MULTI-USER MULTI-TASKING MULTI-PROCESSOR

ibs Betasystem II



THE FINEST OPERATING SOFTWARE AVAILABLE ON A MICRO

- The enormously popular UCSD PASCAL™ extended by IBS to allow up to 8 simultaneous and independent timeshared users, including
  - powerful screen oriented text editor
  - PASCAL and BASIC compliers
  - file handling system with interlocks for multiple access files
  - segmentation and precompiled "units" facilities
  - easily reconfigurable I/O unit assignment
- CP/M™ and MP/M™ available
- Multiple independent Z-80 processors for up to 10 users. Each processor card has 64K RAM, Z-80 processor, 2 serial, 2 parallel ports, optional hardware floating point (available July, 1980)
- Wide variety of applications software including medical office, retail point-of-sale, and general accounting and taxes

WIDE RANGE OF CONFIGURATION OPTIONS

- 2 to 4 Micropolis™ 5.25" floppy drives for 1.2 Mbyte storage
- 11 to 40 Mbyte 8" winchester drives
- 17 Mbyte cartridge or 110 Mbyte video tape backup
- Up to 400kbyte RAM, 336k configurable as super-fast "RAM DISK"
- I/O cards (each with 4 bidirectional fully buffered parallel ports with hardware stobe generation and 4 software-selectable baud rate serial ports) to drive virtually ANY combination of peripherals
- Low price — floppy systems from $4,695.00

THE SINGLE HANDSOME DESKTOP ENCLOSURE WITH ALL THE FEATURES YOU'VE DREAMED OF

- 12 slot S-100 fully terminated bus, giving the versatility of components from many different manufacturers
- 4 Mhz Z-80 processor for high throughput and extended software compatibility
- Dual Whisperfan cooling and optimal heat-sinking for maximum reliability and long life.
- High capacity power supply adequate for all system configurations and upgrades
- Chassis designed for easy interchange of mass storage media
- On-off-reset switch protects against inadvertent reset or unauthorized access
- Furniture quality cabinet

ibs INDEPENDENT BUSINESS SYSTEMS INC 5476 Cleo Ct., Livermore, CA 94550 (415) 443-3131

Distributors: TYPE III, 3021 Germantown Pike, Fairview Village, PA (215) 539-0122
ELIF, 725 DeCarie, Suite 304, Saint-Laurent, Canada; H4L3L4 (514) 747-4751
EEI, P.O. Box 5088, Sharjah, U.A.E. Tel: 354688, Telex: 68188 EEI SH

DEALER INQUIRIES INVITED

UCSD PASCAL is a trademark of the Regeants of the University of California.
CP/M and MP/M are trademarks of Digital Research, Inc.

Listing 1: *This is the final version of my Pascal Eclipse Control Program as used in Kenya, February 16, 1980. Major changes from the previously published version include filling in the details of real-time execution and modifying the exposure table to provide twenty-five shots instead of ten. Also added was an interactive option to reenter the the exposures allocation phase so that different combinations of diamond ring and totality exposures could be tried. Initialization now puts in a symmetrical rising and falling sequence of exposure times from 1 ms to 10,000 ms. All interactive texts have been adjusted so that they will fit the 40-character width of the Apple's built-in video display.*

```
{     N O T E S   A B O U T   T H E   D E S I G N   P R O C E S S   }
{}
{    Step 1: High Level Description  - begun November 22, 1979        }
{         This is a first cut at a program to simulate the eclipse    }
{      photography process, and define some of the necessary global   }
{      data of the problem.                                           }
{                    COMPLETED 11/24/79                               }
{}
{    Step 2: Fill in allocation details -                             }
{         Achieve a complete allocation of the eclipse camera con-    }
{      trol function as evidenced by calculation of a detailed time   }
{      line for the eclipse event given various conditions:           }
{             Given:                                                  }
{                n   = number of totality exposures                   }
{                m   = number of diamond ring exposures               }
{                t   = totality time                                  }
{                s   = slack in allocated totality time               }
{             Then let us seek the following...                       }
{              * d2  = diamond ring time at 2nd contact               }
{              * d3  = diamond ring time at 3rd contact               }
{              * z   = extra slack (one half of diamond ring total)}
{              * p   = anticipation time (half first diamond ring)    }
{              * A   = required time for exposures during totality    }
{              * a   = allocated totality time for exposures          }
{              * x   = margin per frame in totality                   }
{             Theorems:                                               }
{                d2,d3 derived from table of diamond ring frames      }
{                A   derived from table of totality frames            }
{                z = (d2 + d3)/2                                      }
{                p = d2 / 2                                           }
{                a = t - s - z                                        }
{                x = (a - A) / n                                      }
{                                                                     }
{           PROCEDURES Detailed Here Are...                           }
{              initialize                                             }
{              normalize                                              }
{                    COMPLETED 12/16/79                               }
{}
{    Step 3: Fill in the simulated details...                         }
{          Create a program which uses the results of step 3 to       }
{      go through a detailed time line of the experiment on paper     }
{      (or terminal screen).  Each event (shutter transition          }
{      open-->close or close-->open will be marked by a report of     }
{      its nature and time of execution relative to <start> signal    }
{                                                                     }
{           PROCEDURES Detailed Here Are...                           }
{              await_cue                                              }
{              diamond_ring_burst                                     }
{              totality                                               }
{}
{    Step 4: Adapt to real time control -                             }
{         Put in augmentations of the software to actually demon-     }
{      strate operation with the Nikon F2A camera via a relay         }
{      plugged into the Apple II Game Paddle Socket                   }
{      THIS IS THE FINAL FORM OF THE PROGRAM TO BE USED IN THE        }
{      FIELD CONTROLLING THE EXPERIMENT...                            }
{         Necessary step: determining a method of measuring time      }
{      intervals from the CPU clock which is consistent with UCSD     }
{      Pascal.  Possibly use assembly language subroutine.            }
{}


PROGRAM eclipse_monitor_simulation;


  CONST
    minimum_pulse_width = 20 (milliseconds);
    overhead_duration = 210 (milliseconds);
    open_shutter_address  = -16295 (sets AN0 output to "1");
    close_shutter_address = -16296 (resets AN0 output to "0");
    post_ring_delay = 500 (milliseconds);

  TYPE
    seconds      = INTEGER;
    milliseconds = INTEGER;
    absolute_time =
      RECORD
```

Listing 1 continued on page 58

fired up the generator to supply power. We then set up our respective Apples. We naively thought that final programming details could be accomplished that day sitting in the tropical sun. But our preparations had neglected to include a canopy or sun shade. Norm's Apple worked quite well in the heat, perhaps because he had rigged up a sort of sun shade using his towel, two camera tripods, and a large piece of gaily colored cloth.

My Apple, however, had been baking in its carrying case all morning before I set it up. Its integrated circuits were hot to touch even before I turned it on. I turned it on and Pascal booted as usual. I entered my eclipse program and proceded to check it out. But after one or two allocation runs, the operation of the program was rather unusual and erratic. As often happens in such situations, I cycled the power switch in order to reboot the system's software. With this, the system simply refused to operate in a normal fashion! After leaving the system off for about 2 minutes, I was again able to get it started. But it crashed again more quickly.

My conclusion was that the direct sunlight was baking my computer, giving it the electronic equivalent of the sunburn I was so carefully avoiding for myself. It seems that Apples do not work too well when temperatures are elevated to the point where components are too hot to touch. I estimate that the surface temperature of the main board at this time was in the range of 150° to 180°Fahrenheit (66° to 82° Celsius). Noting the excessive heat, I just turned off the system and thought about strategies for keeping it cool and out of sunlight until the eclipse happened. That evening after sunset and before the nightly parade of hippos began, I verified that the computer was still functional.

As it turns out, heat was not a problem the next day, February 16, 1980. The day of the eclipse broke with a solid overcast, not an auspicious beginning. If first contact were to have occurred at 8:30 in the

Text continued on page 66

Listing 1 continued:

```
            units        : seconds;
            thousandths : milliseconds
         END;
      exposures     = INTEGER;
      an_exposure_detail =
         RECORD
            duration     : milliseconds;
            wait_after   : milliseconds
         END;
      string_pointer = ↑STRING;


   VAR
      s                   : STRING[128];
      crash_ahead         : BOOLEAN;

      an_integer         : INTEGER;

      x,n                 : INTEGER;
      sigma               : INTEGER;
      which_ring          : (second,third);

      a,b,c                 : absolute_time;
      ring_time             : absolute_time;
      second_contact_ring : absolute_time;
      third_contact_ring  : absolute_time;
      tot_time              : absolute_time;
      time_totality         : absolute_time;
      margin_time           : absolute_time;
      current_time          : absolute_time;
      half_time             : absolute_time;
      quarter_time          : absolute_time;
      slack_in_totality     : absolute_time;
      dummy                 : absolute_time;
      total_elapsed_time    : absolute_time;
      total_duration        : absolute_time;

      maximum               : exposures;
      total_eclipse         : exposures;
      ring_frames           : exposures;
      current_shot          : exposures;

      twenty_five_shots : PACKED ARRAY[0..24] OF an_exposure_detail;
      transient_shots   : PACKED ARRAY[0..1] OF an_exposure_detail;

<<<< opening "EUTILS.TEXT>>>>

(    Miscellaneous routines used throughout the program }
(       ---> new_page              }
(       ---> set_parameter         }
(       ---> error_abort           }
(       ---> subtract_time         }
(       ---> divide_time           }
(       ---> add_time              }
(       ---> print_time            }
(       --->                       }
(       --->                       }
(       --->                       }
(       --->                       }
(       --->                       }



   PROCEDURE new_page;
      VAR
         stuff : STRING[24];
         clear_screen : CHAR;
      BEGIN
         stuff := '                           ';
         clear_screen := CHR(24);
         WRITELN(clear_screen,stuff);
         WRITELN(' ');
         WRITELN(' ');
         WRITELN(s)
      END (new_page};

   PROCEDURE set_parameter(VAR time : absolute_time);
      VAR
         a_string : STRING[128];
         i : INTEGER;
         period : BOOLEAN;
         decimal_count : INTEGER;
         factor, result : INTEGER;

         PROCEDURE add_a_digit(position : INTEGER);
            VAR
               digit : INTEGER;
            BEGIN
               digit := (ORD(a_string[position])-ORD('0'));
               IF period THEN
                  BEGIN
```

Listing 1 continued on page 60

MICROTEK

SO RELIABLE WE GIVE YOU

365 DAYS WARRANTY

360	361	362	363	364
355	356	357	358	359
350	351	352	353	354
345	346	347	348	349
340	341	342	343	344
335	336	337	338	339
330	331	332	333	334
325	326	327	328	329
320	321	322	323	324
315	316	317	318	319
310	311	312	313	314
305	306	307	308	309
300	301	302	303	304
295	296	297	298	299
290	291	292	293	294
285	286	287	288	289
280	281	282	283	284
275	276	277	278	279
270	271	272	273	274
265	266	267	268	269
260	261	262	263	264
255	256	257	258	259
250	251	252	253	254
245	246	247	248	249
240	241	242	243	244
235	236	237	238	239
230	231	232	233	234
225	226	227	228	229

TOTAL PEACE OF MIND.

We are business people, just like you. We wouldn't stick our neck out unless we were certain we could back our claims and promises to the last letter. We wouldn't offer a legally binding long-term warranty on our Microtek MT-80, unless we were positive of its solid reliability.

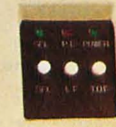
We are sure that our versatile, alphanumeric line printer will provide you consistent, dependable performance. This is why we give you, not the usual 90-days in fine print, but an incredible 365-days warranty. We stand behind every product we make.

LOADED WITH INNOVATIONS

- 40, 80 or 120 columns (software selectable)
- Non-thermal paper, pin feed
- 125 CPS, 70 lines per minute
- 9 × 7 dot matrix
- Vertical format unit
- 96-character ASCII (upper and lower case)
- Adjustable forms width to 9½″
- Parallel and serial (RS-232C) interfaces available

OUR UNIT PRICE
$795 Parallel
$895 Serial (RS-232C)





RELIABILITY

For more information contact:

MICROTEK, Inc.
9514 Chesapeake Dr.
San Diego, CA 92123
Tel. (714) 278-0633
TWX 910-335-1269

Listing 1 continued:

```
                    decimal_count := decimal_count + 1;
                    IF decimal_count < 4 THEN
                       BEGIN
                          time.thousandths := time.thousandths
                              + ((1000 * digit) DIV factor);
                          factor := 10 * factor
                       END
                 END
              ELSE {before period}
                 time.units := (time.units * factor) + digit
           END;

     BEGIN {set_parameter}

     PAGE(OUTPUT);
     time.units := 0;
     time.thousandths := 0;
     WHILE ((time.units=0) AND (time.thousandths=0)) DO
        BEGIN
           factor := 10;
           decimal_count := 0;
           period := FALSE;
           WRITELN(s);
           READLN(a_string);
           FOR i := 1 TO LENGTH(a_string) DO
              BEGIN
                 CASE a_string[i] OF
                   '0','1','2','3','4','5','6','7','8','9':
                       add_a_digit(i);
                   '.':
                       period := TRUE
                 END
              END
        END {WHILE}
  END {set_parameter};

PROCEDURE error_abort;
  BEGIN
     maximum := 250;
     total_eclipse := 200;
     ring_frames := 25;
     WRITELN('Unrecoverable error in data');
     crash_ahead := FALSE
  END;

PROCEDURE subtract_time(a,b : absolute_time; VAR c : absolute_time);
  BEGIN
     c.thousandths := a.thousandths - b.thousandths;
     sigma := 0;
     IF c.thousandths < 0 THEN
        BEGIN
           c.thousandths := c.thousandths + 1000;
           sigma := -1
        END;
     c.units    := a.units    - b.units    + sigma
  END;

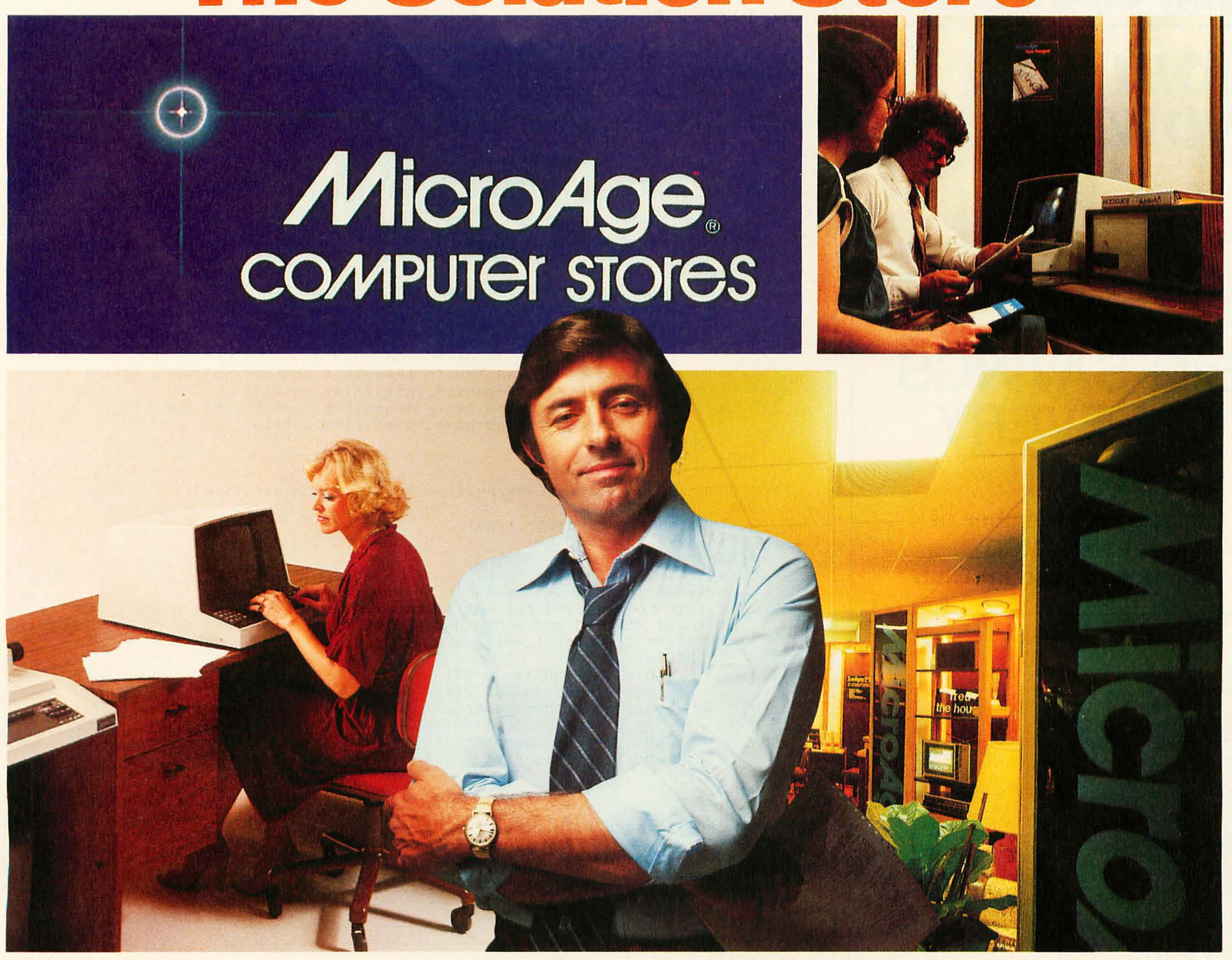
PROCEDURE divide_time(
                        VAR a : absolute_time;
                        b : absolute_time;
                        n : INTEGER
                       );
   { a <-- b DIV n }
   VAR
      p,q : INTEGER[16];
   BEGIN
      a.thousandths := 0;
      a.units := 0;
      q := b.units;
      q := q * 1000;
      q := q + b.thousandths;
      q := q DIV n;
      p := q DIV 1000;
      IF p < 32768 THEN
         a.units := TRUNC(p);
      p := q - (1000 * p);
      IF p < 32768 THEN
         a.thousandths := TRUNC(p)
   END;

PROCEDURE add_time(a,b : absolute_time; VAR c : absolute_time);
   BEGIN
      sigma := a.thousandths + b.thousandths;
      c.thousandths := sigma MOD 1000;
      c.units    := a.units    + b.units    + (sigma DIV 1000)
   END;

PROCEDURE print_time(a : absolute_time);
   VAR
      z1000,z100 : STRING[1];
   BEGIN
      IF a.thousandths < 100 THEN z1000 := '0' ELSE z1000 := '';
      IF a.thousandths < 10 THEN z100 := '0' ELSE z100 := '';
      IF LENGTH(s) > 25 THEN s := COPY(s,1,25);
      WRITELN(s,a.units,'.',z1000,z100,a.thousandths)
```

Listing 1 continued on page 62

The Solution Store



Your Computer Store for the 80's.

MicroAge Computer Stores were designed for the 80's . . . and beyond. Designed to provide solutions, not just to sell hardware. From systems integration to easy-to-use application software. From research and development to warranty service and repair. From systems consulting to training and installation. In all these, we are the acknowledged leaders, the industry pioneers. The model for all computer stores of the future.

Don't just take our word for it. Visit the MicroAge Computer Store nearest you. You'll leave with a whole new idea about what a computer store is all about . . . and will be for years to come.

MicroAge® COMPUTER STORES

Circle 32 on inquiry card.

Paradise Valley Mall (Cactus Rd. & Tatum Blvd.) Phoenix, Arizona

1220 Melbourne Dr. Hurst, Texas

2525 N. Scottsdale Rd. Scottsdale, Arizona

Spring Valley Rd. & Coit St. Richardson, Texas

2612 East Broadway Tucson, Arizona

24 West Camelback Rd. Phoenix, Arizona

For franchise opportunities, contact the director of franchising, (602) 967-1421.

Listing 1 continued:

```
        END;
<<<< opening "ENORMAL.TEXT>>>>

PROCEDURE normalize_timing;
    VAR
        i                   : INTEGER;

    PROCEDURE sum_up_ring(ring: INTEGER; VAR ring_total : absolute_time);
        VAR
            index,i : INTEGER;
            this_ring : absolute_time;

        BEGIN
            ring_total.units        := 0;
            ring_total.thousandths  := post_ring_delay;
            FOR i := 1 TO ring_frames  DO
                BEGIN
                    this_ring.units := 0;
                    this_ring.thousandths := transient_shots[ring].wait_after;
                    add_time( this_ring,ring_total,ring_total );
                    this_ring.thousandths := transient_shots[ring].duration;
                    add_time( this_ring,ring_total,ring_total )
                END
        END;

    PROCEDURE sum_up_eclipse( VAR eclipse_total : absolute_time);
        VAR
            this_shot : absolute_time;
            index,i,j : INTEGER;
        BEGIN
            eclipse_total.units := 0;
            eclipse_total.thousandths := overhead_duration;
            ( this compensates for the minimum wait after one      }
            ( frame started and ended during the slack time period}
            FOR i := 1 TO total_eclipse DO
                BEGIN
                    this_shot.units := 0;
                    index := (i-1) MOD 25;
                    this_shot.thousandths := twenty_five_shots[index].wait_after;
                    add_time( this_shot,eclipse_total,eclipse_total );
                    this_shot.thousandths := twenty_five_shots[index].duration;
                    add_time( this_shot,eclipse_total,eclipse_total )
                END
        END;

 PROCEDURE preliminary_allocation;
    BEGIN
        s := 'Allocation of Eclipse Times...';
        new_page;
        s := 'Total time of eclipse   = ';
        print_time( time_totality );

        WRITELN( '----------------------------------------' );
        which_ring := second;
        sum_up_ring( ORD( which_ring ),second_contact_ring );

        s := 'Second contact time     = ';
        print_time( second_contact_ring );

        which_ring := third;
        sum_up_ring( ORD( which_ring ),third_contact_ring );

        s := 'Third contact time      = ';
        print_time( third_contact_ring );

        add_time( second_contact_ring,third_contact_ring,ring_time );
        s := 'Tot. diamond ring time = ';
        print_time( ring_time );
        divide_time( quarter_time,second_contact_ring,2 );
        s := 'Anticipation time       = ';
        print_time( quarter_time );

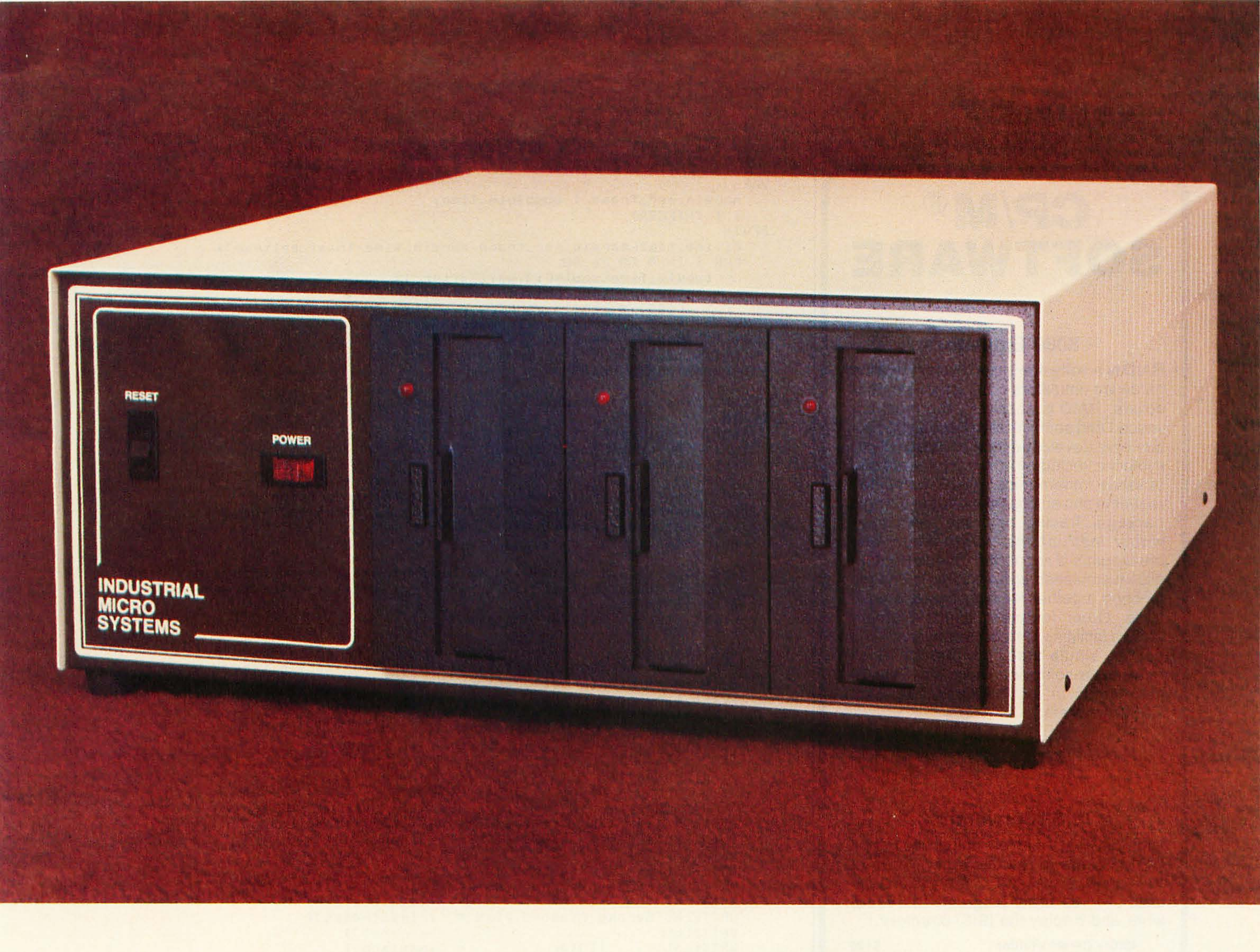

        WRITELN( '----------------------------------------' );
        sum_up_eclipse( tot_time );
        s := 'Totality time           = ';
        print_time( tot_time );
        s := 'Margin at end totality = ';
        print_time( slack_in_totality );

        divide_time( half_time,ring_time,2 );
        s := 'Diamond ring slack      = ';
        print_time( half_time );

        add_time( tot_time,slack_in_totality,total_duration );
        add_time( total_duration,half_time,total_duration );
        s := 'Total time initially    = ';
        print_time( total_duration );

        WRITELN( '-----------------------------------------------------' );
        subtract_time( time_totality,total_duration,margin_time );
        s := 'Margin for allocation   = ';
        print_time( margin_time )
    END (preliminary_allocation);
```

Listing 1 continued on page 64



More than meets the eye.

The new Series 5000 is mighty for its size. In more than several thousand ways!

In fact, it's the first small system offering over a megabyte of integrated mini-floppy capacity. And with its super memory management, you can have better than 300k of RAM in desk or desktop versions. But hardware is just the beginning of the story.

It's the wide selection of software that really makes this system mighty.

Operating systems? Choose CP/M* with CBASIC†—the most widely accepted small computer operating system ever. Or MVT-FAMOS,** a multi-user, multi-tasking operating system with file management like the big guys, Or MICROCOBOL,†† also for multiple users, but implemented in COBOL, familiar to commercial users the world over.

And applications programs for these operating systems number in the thousands. From real estate to accounting, taxes to inventory control. they're all available at low cost—ready to run.

When you add these software and hardware features to Industrial Micro Systems' reputation for rugged, reliable quality products you'll begin to see it all. A lot more systems than your first glance reveals.

See even more at your dealer. Call us to find out the name of your nearest dealer. He'll tell you everything you need to know. And really open your eyes!

*Trademark of Digital Research Inc. **Trademark of MVT Microcomputer Systems Inc. †Trademark of Software Systems ††Product of CAP-CPP

INDUSTRIAL MICRO SYSTEMS

628 N. Eckhoff St., Orange, CA 92668, (714) 978-6966
2800 Lockheed Way, Carson City, NV 89701

Listing 1 continued:

```
PROCEDURE margin_dispersal;
   VAR
      margin_per_frame : absolute_time;
      i : INTEGER;
   BEGIN
      divide_time( margin_per_frame,margin_time,total_eclipse );
      FOR i := 0 TO 24 DO
         twenty_five_shots[i].wait_after :=
            twenty_five_shots[i].wait_after +
            (1000 * margin_per_frame.units) +
            margin_per_frame.thousandths;
      s := 'Margin per tot. frame  = ';
      print_time( margin_per_frame )
   END {margin_dispersal};

PROCEDURE final_allocation;
   BEGIN
      sum_up_eclipse( tot_time );
      s := 'Adjusted total phase    = ';
      print_time( tot_time );

      add_time( tot_time,slack_in_totality,total_duration );
      add_time( total_duration,half_time,total_duration );
      s := 'Adjusted commitments    = ';
      print_time( total_duration );

      add_time( tot_time,slack_in_totality,total_elapsed_time );
      add_time( total_elapsed_time,ring_time,total_elapsed_time );
      s := 'Total elapsed time      = ';
      print_time( total_elapsed_time );

      WRITELN( '-----------------------------------------------------' );
      subtract_time( time_totality,total_duration,margin_time );
      s := 'Margin after allocation= ';
      print_time( margin_time )
   END {final_allocation};

PROCEDURE alloc_exposures;
   BEGIN
      ring_frames :=
         (maximum - total_eclipse) DIV 2;
      IF ring_frames < 2 THEN error_abort;
      sigma := maximum - (total_eclipse + (2 * ring_frames));
      total_eclipse := total_eclipse + sigma;
      WRITELN( '' );
      WRITELN( '        Exposures map:' );
      WRITELN( 'First diamond ring  = ',ring_frames );
      WRITELN( 'Totality            = ',total_eclipse );
      WRITELN( 'Second diamond ring = ',ring_frames );
      WRITELN( '                      --------' );
      WRITELN( '        TOTAL       = ',maximum );
      WRITELN( '' );
      WRITELN( '' );
      WRITELN( 'Press return to continue' );
      READLN( s )
   END {alloc_exposures};

   BEGIN {normalize_timing}

      alloc_exposures;

      preliminary_allocation;

      margin_dispersal;

      final_allocation

   END {normalize_timing};

PROCEDURE milli( time : INTEGER );
   EXTERNAL;

PROCEDURE ref_memory( address : INTEGER );
   { This procedure uses the variant record technique to
      reference an address passed to it as a 16 bit signed
      INTEGER.  The Apple-II hardware will set or reset the
      annunciator outputs of the Game I/O connector if the
      appropriate addresses are simply referenced by a program.
   }

   TYPE
      ptr = ↑CHAR;

      memory_access = (pointer,number)
      {this is a dummy statement required by the syntax of
         Pascal variant records such as "memory" below. The
         variant record "trick" is not the most elegant way
         to reference an absolute hardware address, since it
         requires an implementation-dependent assumption about
         variant records, ie: that a 16 bit signed two's complement
         INTEGER type maps bit for bit into the 16 bit positive
         integer value of an address stored in a Pascal pointer
         data type.
      };
```

Listing 1 continued on page 66

Universal Data Systems

Break out with our breakthrough!

Give your small computer a UDS 103-LP modem for less than $200

End your isolation. Talk to the rest of the world. Add a UDS 103-LP modem to your personal or small business computer system and you'll have access to the whole dial-up telephone network.

You can communicate with time-sharing services, fellow computer buffs or the larger systems of your customers and suppliers. And, thanks to our breakthrough, the investment is less than $200.

You get a fully Bell-compatible, originate only, Model 103 modem. It offers full duplex communications capability at any speed from 0 to 300 bps. It fits right under your phone, is FCC certified for direct connection to the telephone network and requires no AC power source. All required operating power comes directly from the phone line itself.

Break out now by getting full details.
Contact Universal Data Systems,
5000 Bradford Drive, Huntsville, AL 35805.
Telephone 205/837-8100.
TWX 810-726-2100.
Patent Applied For

Member IDCMA

"Confidence in Communications"

Universal Data Systems



Text continued from page 56:

morning as was the case in Montana last year, we would have missed the eclipse. But by the time of first contact, about 10 AM, the clouds had dissipated somewhat in the hot sun, to the point where maybe 50% of the time the sun was obscured. What this early cloudiness did, however, was keep my Apple from getting too hot too soon.

As the eclipse progressed, the air cooled off. Whether this lack of insolation due to the early phases of the eclipse affected the weather or not, it certainly helped guarantee the performance of my Apple during the total phase of the eclipse. At 11 AM when I turned on the power to my computer, it was delightfully cool in comparison with the previous afternoon. The weather had also improved considerably. We seemed by this time to be in a beautiful bowl of clear blue sky with the nearest clouds perhaps 5 to 10 miles away. This perfect eclipse-viewing weather lasted until well after the end of the event.

The Pascal system booted properly, and I proceeded to set up the final allocation I would use. Because I wanted to take a few partial phase shots manually, I had decided earlier that morning to limit the shots of totality to 200 exposures, with 120 taken during actual totality and the balance of 80 split equally between the two diamond-ring events. A slack time of 40 seconds was chosen to allow for the extra long exposure toward the end of the eclipse. Just to keep verifying the operation of the computer, I kept reentering the allocation phase of the program every few minutes.

Finally, at 11:21 AM, totality was heralded by a beautiful set of "shadow bands." After watching these last glimmers of direct sun, I removed the filter from my camera and gave the first manual cue to my eclipse program. I then had four enjoyable minutes of direct viewing of the eclipse, its effects on the local animal life, a glimpse of sunlight still illuminating the upper part of Kilimanjaro, and the incredible colorations of the distant clouds on the

Listing 1 continued:

```
      memory =
         RECORD
            CASE memory_access OF
               pointer : (a_pointer : ptr);
               number  : (a_number : INTEGER)
         END;

   VAR
      anybyte : memory;
      anychar : CHAR;

   BEGIN
      anybyte.a_number := address;
      anychar := anybyte.a_pointer↑
   END {ref_memory};

PROCEDURE take_picture(photograph : an_exposure_detail);
   BEGIN
      ref_memory(open_shutter_address);
      milli(photograph.duration);
      ref_memory(close_shutter_address);
      milli(photograph.wait_after)
   END {take_picture};



PROCEDURE initialize;
   VAR
      running_index : INTEGER;
   BEGIN {initialize}
      s := '';
      ref_memory(close_shutter_address);
      current_time.units        := 0;
      current_time.thousandths := 0;
      current_shot := 0;
      twenty_five_shots[0].duration    := 1     + minimum_pulse_width;
      twenty_five_shots[1].duration    := 2     + minimum_pulse_width;
      twenty_five_shots[2].duration    := 5     + minimum_pulse_width;
      twenty_five_shots[3].duration    := 10    + minimum_pulse_width;
      twenty_five_shots[4].duration    := 20    + minimum_pulse_width;
      twenty_five_shots[5].duration    := 50    + minimum_pulse_width;
      twenty_five_shots[6].duration    := 100   + minimum_pulse_width;
      twenty_five_shots[7].duration    := 200   + minimum_pulse_width;
      twenty_five_shots[8].duration    := 500   + minimum_pulse_width;
      twenty_five_shots[9].duration    := 1000  + minimum_pulse_width;
      twenty_five_shots[10].duration   := 2000  + minimum_pulse_width;
      twenty_five_shots[11].duration   := 5000  + minimum_pulse_width;
      twenty_five_shots[12].duration   := 10000 + minimum_pulse_width;
      twenty_five_shots[13].duration   := 5000  + minimum_pulse_width;
      twenty_five_shots[14].duration   := 2000  + minimum_pulse_width;
      twenty_five_shots[15].duration   := 1000  + minimum_pulse_width;
      twenty_five_shots[16].duration   := 500   + minimum_pulse_width;
      twenty_five_shots[17].duration   := 200   + minimum_pulse_width;
      twenty_five_shots[18].duration   := 100   + minimum_pulse_width;
      twenty_five_shots[19].duration   := 50    + minimum_pulse_width;
      twenty_five_shots[20].duration   := 20    + minimum_pulse_width;
      twenty_five_shots[21].duration   := 10    + minimum_pulse_width;
      twenty_five_shots[22].duration   := 5     + minimum_pulse_width;
      twenty_five_shots[23].duration   := 2     + minimum_pulse_width;
      twenty_five_shots[24].duration   := 1     + minimum_pulse_width;
      FOR running_index := 0 TO 24 DO
         twenty_five_shots[running_index].wait_after  := overhead_duration;

      transient_shots[0].duration    := 5      + minimum_pulse_width;
      transient_shots[1].duration    := 50     + minimum_pulse_width;
      FOR running_index := 0 TO 1 DO
         transient_shots[running_index].wait_after  := overhead_duration;

      s := 'Restarting the program';
      new_page;
      WRITELN('Enter 0 to end, 1 to continue');
      WRITELN('   then <return>        ');
      READLN(an_integer);


      IF an_integer > 0 THEN
         BEGIN
            s := 'Preliminary data initialization';
            new_page;
            s := '   Enter number of exposures';
            set_parameter(dummy);
            maximum := dummy.units;
            s := 'Enter exposures in totality';
            REPEAT
               BEGIN
                  set_parameter(dummy);
                  total_eclipse := dummy.units
               END
```

Listing 1 continued on page 68


PERCOM

horizon. I used a second camera with a wide-angle lens to take several hand-held pictures. Eventually the moment passed as Norm announced the coming of third contact as predicted by his computer program running in conjunction with a Mountain Hardware real-time clock. Perhaps a bit too late, I gave my second manual cue to my program, and I prepared to apply the lens cap to protect the camera and optics.

The rest of the trip was, of course, anticlimactic. I had the satisfaction of having had my program work as planned, the good fortune of avoiding a repeat of the thermal problems of the day before the eclipse, and the knowledge that a significant improvement in eclipse viewing can be achieved using a computer system. We returned home the next Thursday, and by Friday noon I was able to view the images photographed by my system during those 4 minutes in Tsavo the Saturday before. I don't know when I will next see a solar eclipse, but I am sure that whatever the state of the art of microcomputers at the time, I will be using one to improve my automation of photography of the 1980 eclipse.

Articles Policy

BYTE is continually seeking quality manuscripts written by individuals who are applying personal computer systems, designing such systems, or who have knowledge which will prove useful to our readers. For a more formal description of procedures and requirements, potential authors should send a large (9 by 12 inch, 30.5 by 22.8 cm), self-addressed envelope, with 28 cents US postage affixed, to BYTE Author's Guide, 70 Main St, Peterborough NH 03458.

Articles which are accepted are purchased with a rate of up to $50 per magazine page, based on technical quality and suitability for BYTE's readership. Each month, the authors of the two leading articles in the reader poll (BYTE's Ongoing Monitor Box or "BOMB") are presented with bonus checks of $100 and $50. Unsolicited materials should be accompanied by full name and address, as well as return postage.

Listing 1 continued:

```
            UNTIL
               (total_eclipse > 0)
                           AND
               (total_eclipse < maximum);
            s := 'Enter totality duration (sec)';
            set_parameter(time_totality);
            s := 'Enter slack time (sec)';
            set_parameter(slack_in_totality)
         END;
      crash_ahead := TRUE
   END {initialize};

PROCEDURE await_cue;
   VAR
      anychar : PACKED ARRAY[0..0] OF CHAR;
   BEGIN {await_cue}
      WRITELN('');
      WRITELN('');
      WRITELN('');
      WRITELN('**********************');
      WRITELN('Awaiting manual cue');
      WRITELN('**********************');
      UNITREAD(2,anychar,1,0,0)
   END {await_cue};

PROCEDURE diamond_ring_burst;
   VAR
      i : INTEGER;
   BEGIN {diamond_ring_burst}
      FOR i := 1 TO ring_frames DO
         BEGIN
            IF which_ring = second THEN
               take_picture(transient_shots[0])
            ELSE
               take_picture(transient_shots[1])
         END;
      milli(post_ring_delay)
   END {diamond_ring_burst};

PROCEDURE totality;
   VAR
      exposure_count : INTEGER;
      cyclic_choice  : INTEGER;
   BEGIN {totality}
      WRITELN('Begin totality sequence');
      cyclic_choice := 0;
      FOR exposure_count := 1 TO total_eclipse DO
         BEGIN
            take_picture(twenty_five_shots[cyclic_choice]);
            cyclic_choice := (cyclic_choice + 1) MOD 25
         END;
      WRITELN('End totality sequence')
   END {totality};

PROCEDURE summarize;
   BEGIN {summarize}
      WRITELN('Press return to end program');
      READLN(s)
   END {summarize};


PROCEDURE perform_eclipse_dance;
   BEGIN
      await_cue;
      diamond_ring_burst;
      totality;
      ref_memory(open_shutter_address); {sneak in one more exposure}
      await_cue;
      ref_memory(close_shutter_address);
      milli(overhead_duration);
      diamond_ring_burst
   END;


BEGIN {eclipse_monitor_simulation}
   an_integer := 100;
   WHILE an_integer > 0 DO
      BEGIN
         initialize;
         IF an_integer > 0 THEN
            BEGIN
               normalize_timing;
               WRITELN('Is this an eclipse run? (Y = yes)');
               READLN(s);
               IF LENGTH(s) < 1 THEN s := ' ';
               IF ((s[1] = 'y') OR (s[1] = 'Y')) THEN
                  perform_eclipse_dance
            END
      END;
   summarize
END. {eclipse_monitor_simulation}
```

Your micro-computer deserves the best in data base management

Get the most out of your micro-computer. Use an advanced and progressive data management system...one with many large-computer features...one designed to meet your present *and* future needs.

HDBS is an extended hierarchical data base system offering

1. fixed length records
2. file-level read/write protection
3. one-to-many set relationships

MDBS is a full network data base system offered as an upgrade from HDBS...or it may be ideal as your initial system. **Unique and versatile**, it adds these features:

4. full network CODASYL-oriented data structures
5. variable length records
6. multiple levels of read/write protection
7. one-to-one, many-to-one, and many-to-many sets
8. non-redundancy of data, easy updating
9. occurences of a record type may own other occurrences of the same type
10. a single set may have multiple owner and member record types

MDBS-DRS. As an add-on to MDBS, the DRS system offers extraordinary flexibility in data base restructuring to meet new needs.

11. Item, record, and set types can be added, deleted, or renamed in an existing data base as well as other data base characteristics. You can redesign the data base after it is already on-line!

HDBS and MDBS Packages include:

- DDL data definition language analyzer/editor
- 260-page users manual
- DMS data management routines callable from host language
- Sample application program and DDL files
- Relocator to re-org all routines
- System specific manual for bringing up our software



Write or call for free copy of 54-page "primer" on data base systems for micro-computers.

Both HDBS and MDBS Systems...

a. Run under CP/M (and similar derivatives) with Microsoft BASICs, FORTRAN or COBOL; under North Star DOS with North Star BASIC; under TRSDOS or NEWDOS with TRS Disk BASIC and with Apple DOS and Applesoft BASIC. Machine language callable forms also available.

b. Up to 254 record-types definable in the data base; each record-type may contain up to 255 item-types; each item-type may be up to 9,999 bytes in length.

c. Names of data items, records, sets, and files are wholly user definable.

d. Command to add, delete, update, search, and traverse the data base.

e. Straightforward use of ISAM-like structures.

f. Records can be maintained in several sorted orders.

g. Written in machine language for maximum execution efficiency and minimal memory usage.

h. Independent of types and sizes of disk drives. Support data base spread over several disk drives (max. 8); disks may be mini- or full-sized floppies or hard disks.

i. Available in versions Z80 (requires approx. 18K), 6502 (approx. 26K), and 8080 (approx. 22K).

Ordering and pricing information:

HDBS - Z80	$250.00	MDBS - Z80	$750.00
HDBS - 6502	325.00	MDBS - 6502	825.00
HDBS - 8080	325.00	MDBS - 8080	825.00
HDBS/MDBS Manual	35.00	MDBS/HDBS Manual	35.00
HDBS - Upgrade to MDBS	550.00	MDBS - DRS add-on	100.00
System Specific Manual (each)	5.00	MDBS - DRS Manual	5.00

For machine language callable forms, add $75.00

Add $2.50 handling fee for non-cash order ($5.00 outside U.S.).

We accept Visa and Master Charge.

Indiana residents add 4%.

When ordering, specify intended use with...

1. North Star DOS and BASIC
2. CP/M - Microsoft BASIC 4.XX
3. CP/M - Microsoft BASIC 5.XX
4. CP/M - Microsoft BASIC Compiler or FORTRAN-80
5. CP/M - Microsoft COBOL-80
6. TRSDOS and TRS Disk BASIC
7. NEWDOS and TRS Disk BASIC
8. CP/M - machine language callable form
9. Apple DOS and Applesoft BASIC
10. (Other versions coming)

Name (please print) ____________ Phone ____________

Company ____________ Address ____________

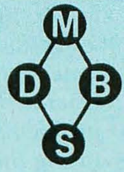
City ____________ State ______ Zip ______

Master Charge # ____________ Bank # ____________

Visa # ____________ Expr. date (either card) ____________

Finally, our software may cost a little more... but it's worth a lot more in quality and versatility.

Micro Data Base Systems, inc.



Box 248, Lafayette, Indiana 47902 / 317-742-7388

Circle 38 on inquiry card.

Critique of Technique

This use of computer automation in photographing a solar eclipse provided a valuable improvement over manual methods. Computer automation allowed me to plan an exposure sequence which would be executed without relatively error-prone manual operations. This goal was achieved in the experiment described here. But by building on experience, one can always improve the techniques.

A relatively simple improvement would be to devote some automation to the partial phases of the eclipse. This would be accomplished by adding a loop to take photographs, for example, every five minutes, listening for the manual cue of imminent totality between partial phase shots. This would also assume cool enough temperatures for reliable operation over a 90-minute time span. I left this feature out because I had no idea of the proper exposure time to use and was too busy getting the main goal accomplished.

The problem of determining the mechanical overhead of the Nikon Motor Drive in the "bulb" position needs further attention. The shortest exposures in the 1980 eclipse were dictated by a fixed overhead time needed to ensure reliable triggering of the motor drive. If this time is too long, given the film used, then two options remain: using a slower film, or applying a filter to the lens during totality. The diamond-ring exposure times were much too long for a good photographic result. This problem would go away if a slower film or filters were applied. Since an equatorial telescope mount was tracking the sun during the eclipse, use of slower film would give a shorter effective minimum exposure time without sacrificing resolution with the long shots.

Two problems with my procedures during the 1980 eclipse will not go away given improvements in computer systems techniques. The first problem is that of inadequate timing cues. While it would be possible to use a real-time clock to coordinate with universal time, such an open-loop operation would not necessarily guarantee better timing of the start of the sequences of totality photographs due to imprecision in our knowledge of latitude and longitude at a remote site.

The second difficult problem is forgetting to verify focusing of the camera during the automatic sequence. In this eclipse, I was lucky, because I did not jar the camera while removing the filter. But, quite frankly, I forgot to even look through the viewfinder while the automatic programming sequence was in operation. Had I twisted the barrel of the lens while removing the filter I could have had a real disaster of unfocused results.

And of course, the next time I go to the tropics with a computer, a sun shade of some sort will accompany me.

High-Level Conference

A key part of the success of this application of a personal computer to eclipse photography was the use of a high-level language system for nearly all of the programming. Listing 1 shows the final version of the eclipse camera-control program with an additional month's development from the state shown in listing 1 of the March 1980 editorial. This very successful use of Pascal in a relatively sophisticated engineering application helps emphasize the importance of the high-level-language design approach.

The importance of high-level languages in design extends far beyond any particular application. To help provide our professionally oriented readers with an intensive exposure to the design philosophy of modern software tools for small computers, we have created a seminar on the subject. The seminar is organized in conjunction with the McGraw-Hill Conferences and Seminars group. It will be held at the McGraw-Hill building in New York City, June 16 and 17, 1980. The sessions of "The BYTE Conference on Languages and Tools for Microcomputing" will include six important talks on several essential high-level-language systems concepts for small computers.

Dr Fred Martin of Intermetrics Incorporated will talk about the high-level language-oriented software tools developed for the real-time systems programming of the NASA Space Shuttle flight computers. Dr Peter Grogono, author of Programming in Pascal, *will present the philosophy of Pascal, the predominant block-structured, strongly typed language of contemporary microcomputer usage. Dr Ken Bowles, the driving force behind UCSD Pascal, will provide a fascinating talk entitled "After Pascal, What?" which concerns proposed microcomputer implementations of the US Defense Department's Ada language. John Morse of Digital Equipment Corporation will set Bell Laboratories' C language into a microcomputer context, describing its value as a systems and applications program implementation language. Dr Charles Moore of Forth Incorporated will describe the characteristics of Forth as a programming tool appropriate for small computers. Dr Henry Baker of the University of Rochester will complete this suite of language-oriented tools for microcomputers by presenting information on LISP and its applications. This 2-day intensive conference will end with a panel session in which all the speakers will participate.*

For further information, contact The McGraw-Hill Conference and Exposition Center, 1221 Avenue of the Americas, Rm 3677, New York NY 10020, or see the advertisement in this issue. ■

Interface a Floppy-Disk Drive to an 8080A-Based Computer

John Hoeppner
Shugart Associates
415 Oakmead Pky
Sunnyvale CA 94086

The audio cassette has been used by most of us for off-line storage of programs and data. It has two advantages: it is inexpensive, and it is easy to implement because of the wide variety of cassette interfaces available.

However, I grew tired of waiting for the BASIC interpreter and all my data to be loaded every time I powered up my system. Even then, I sometimes had to load and reload the data until the interpreter and my programs were transferred correctly. I decided to try an alternative.

On one hand, the Shugart minifloppy 5-inch disk drive, which costs about $350, was a little more expensive than my cassette recorder; but, on the other hand, the 5-inch floppy disk it uses costs about the same as a quality cassette tape — around $4. And, despite a higher initial investment, the floppy disk is more reliable, and it can transfer programs and data as much as thirty times faster than the audio cassette. It seemed the more programs that were developed, the more worthwhile the additional investment would be. Also, with a recently introduced integrated circuit from Western Digital, the FD1771 floppy-disk formatter/controller, I could design a controller myself that could be interfaced to my 8080A-based microcomputer system.

Minifloppy is a registered trademark of Shugart Associates used to describe their 5-inch floppy-disk drives.

This article describes the hardware developed to connect a Shugart floppy-disk drive to an 8080A-based system using the Western Digital FD1771 chip, as well as the software routine necessary to drive the FD1771.

The FD1771 disk formatter/controller device is compatible with the IBM 3740 format.

Hardware Characteristics

The 8080A-based microcomputer was one that I designed. However, the components I used are those found on most 8080A single-board computers: an 8080A microprocessor, an 8224 two-phase clock, an 8228 system controller and bus driver, and an 8255 programmable peripheral interface. (See figure 1.) For temporary data storage, I used 2 K bytes of programmable memory, and for my bootstrap loader, I used a 256-byte programmable read-only memory. The microcomputer interfaces to the FD1771 through the programmable peripheral interface (PPI), which can be programmed as three input/output (I/O) ports of eight lines each.

The FD1771 disk controller is compatible with the IBM 3740-type, soft-sectored format, but it can be programmed for other formats. It contains five registers: data, command, sector, track, and status. These registers hold the data and commands transferred from the 8080A processor. The FD1771 has a cyclic redundancy check (CRC) generator for performing a validity check on data transfers. It is also equipped with an internal data separator for separating clock and data bits from the disk into two separate streams. I chose not to use the internal data separator for the following reason.

Each bit of data on the disk is stored during a time interval called a *bit cell*. The bit cell is the space between two of the clock pulses that are recorded on the disk; the beginning of the bit cell is defined by the clock pulse. If the bit is to be recorded as a 1, a pulse is written in the center of the bit cell. If the bit is to be recorded as a 0, no pulse is written in the cell.

The bit pulse must be written on the disk inside certain boundaries. When the pulse is read by the disk drive, the pulse is presented to the controller within a certain time frame called the *data window*. The length of the bit cell is 8 μs. When the clock pulse is detected by the controller, a timer is activated. This timer counts 2 μs; after 2 μs have elapsed, the data window is deemed to be "open." The data window is open during 4 μs, and the bit pulse is expected to be found during the data-window interval. After the interval of the data window in over, the controller looks for another clock pulse to begin the next bit cell.

SuperBrain™

The Honor Graduate

There's been a lot of talk lately about intelligent terminals with small systems capability. And, it's always the same. The systems which make the grade in performance usually flunk the test in price. At least that was the case until the SuperBrain graduated with the highest PPR (Price/Performance Ratio) in the history of the industry.

For less than $3,000*, SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard features include: two dual-density mini-floppies with 320K bytes of disk storage, up to 64K of RAM to handle even the most sophisticated programs, a CP/M Disk Operating System with a high-powered text editor, assembler and debugger. And, with SuperBrain's S-100 bus adapter, you can even add a 10 megabyte disk!

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing . . . the SuperBrain handles all of them with ease.

Your operators will praise the SuperBrain's good looks. A full ASCII keyboard with a numeric keypad and function keys. A non-glare, dynamically focused, twelve inch screen. All in an attractive desktop unit weighing less than a standard office typewriter. Sophisticated users will acclaim SuperBrain's twin Z-80 processors which transfer data to the screen at 38 kilobaud! Interfacing a printer or modem is no problem using SuperBrain's RS-232C communications port. But best of all, you won't need a PhD in computer repair to maintain the SuperBrain. Its single board design makes servicing a snap!

So don't be fooled by all the freshman students in the small systems business. Insist on this year's honor graduate . . . the SuperBrain.

*Quantity one. Dealer inquiries invited.

See us at NCC booth 2240



2300 Broad River Road, Columbia, SC 29210
(803) 798-9100 TWX: 810-666-2115

Circle 41 on inquiry card.

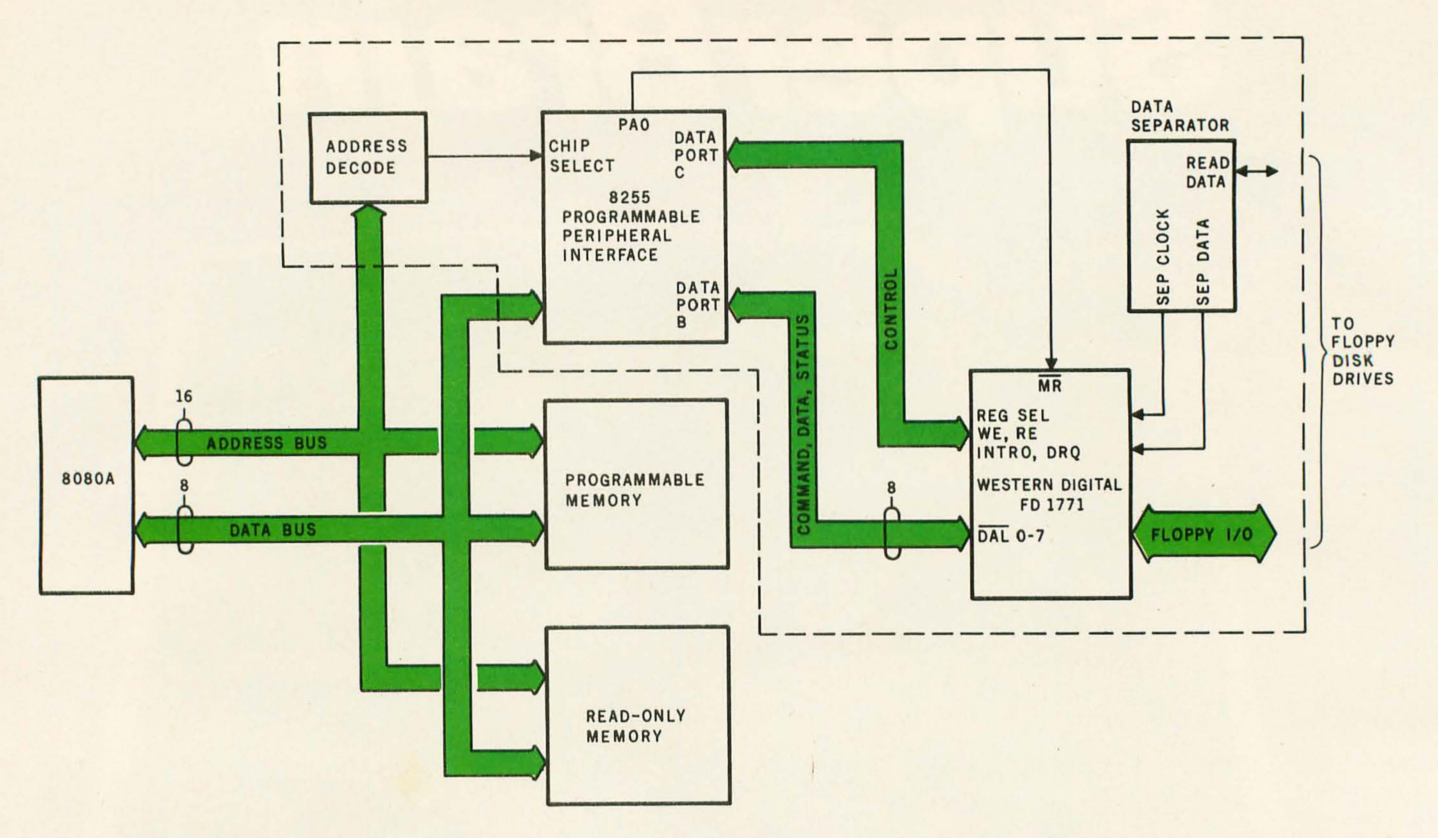


Figure 1: *Block diagram of 8080A-based computer and interface to Shugart SA400 floppy-disk drive. The Western Digital FD1771 disk-controller circuit is illustrated here as the area within the dotted lines.*

The problem with the FD1771 internal data separator arises from the counting after the clock pulse to find the beginning of the data window. The counter in the FD1771 is synchronous with the system clock pulses (at 1 MHz) that are fed into the FD1771. However, the pulses from the disk arrive at the controller *asynchronously*; the variation in the arrival intervals of the pulses is caused by a host of factors. Therefore, the data window as determined by the FD1771 can occupy varying positions within the bit cell. The position may vary by as much as 1 μs (ie: 1 clock cycle) within the 8 μs bit-cell interval.

In worst-case data patterns, this problem may lead to errors and loss of data. Therefore, I provided a data separator of my own design to replace the internal data separator of the FD1771. My data separator was built using a number of discrete logic gates of the 7400 family, as presented in figure 2.

The 5-inch floppy-disk drive I used was a Shugart SA400 minifloppy drive. It is organized to store data in thirty-five independent tracks. Each track contains 3125 unformatted bytes for a total unformatted capacity of 109.4 K bytes per disk. The formatting method I used results in an actual capacity of 71.68 K bytes per disk. The track-to-track access time of the data-transfer (ie: read/write) head is 40 ms. Once the read/write head is positioned above the correct track, another 10 ms of settling time must be allowed before a read or write operation can be performed. The basic data-transfer rate of the drive is 125 K bits per second, which translates to 15.6 K bytes per second. This compares to the audio cassette recorder's transfer rate of about 500 bytes per second.

Connecting the 8255 PPI

The 8255 programmable peripheral interface provides a universal means of interfacing peripheral devices to the 8080 microprocessor. It interfaces to the data bus through the 8228 system controller and bus driver. Three address lines (A0, A1, and A15) of the 8080A are connected to the 8255. Line A15 is connected to the chip select ($\overline{CS}$) line of the 8255, giving the PPI a memory address of hexadecimal 8000. Lines A0 and A1 directly access registers in the 8255. This method of I/O addressing is called memory mapping, because it makes certain memory addresses act as registers for communication between the computer and the peripheral device: it was necessary because the conventional I/O instructions were too slow.

The FD1771 interfaces to the processor through eight data lines (PB0 thru PB7) and seven control lines (PA1, PC0, PC1, PC2, PC3, PC6, and PC7), as shown in figure 2 (page 78). Ports A and B of the PPI, each providing eight lines for transfer of data, interface with the data lines of the FD1771. Three lines of port A also connect directly to the disk drive. Port C of the PPI handles the FD1771 control lines. The eighth control line of the FD1771 is not used, so it is tied to ground.

Six of the outputs of the PPI (PA0 thru PA3, PC2, and PC3) are logically inverted. Because the outputs of *all* ports on the 8255 go low when *any* port is commanded to change direction (from input to output, or vice versa), this inversion is necessary to prevent false signals from going to the FD1771, deselecting the drive and turning off the motor.

Due to total system-timing constraints, disk read and write routines must be performed within 56 μs.

Text continued on page 80

"Percom Sells More Microcomputer Disk Systems Than Any Other Peripherals Manufacturer. I'd like to show you why."

"Percom has been manufacturing mini-disk storage systems for microcomputers since 1977 when we introduced the 35-track, single-drive LFD-400™. Now we produce 1-, 2- and 3-drive systems in 40- and 77-track versions, a multi-density MEGABASE™ system and a host of accessories and software.

"Volume not only means experience in critical production and testing operations, it also means we can offer superior design features, extra testing and qualified backup support at very competitive prices.

"I know of no other microcomputer disk system manufacturer who even begins to offer the broad spectrum of disk equipment and programs available from Percom."

"So before you buy a mini-disk system for your 6800, 6809 or TRS-80* computer, take a good look at what the people at Percom have to offer."

Harold Mauch
President, Percom Data Company

Percom disk systems start at only $399.00. Disk systems and other quality Percom products are available at computer dealers nationwide. **Call toll-free, 1-800-527-1592, for the locations of dealers in your area, or to order direct.**



PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
TM trademark of Percom Data Company, Inc. *trademark of Tandy Radio Shack Corporation which has no relationship to Percom Data Company.

"From an efficient 1K-byte control system DOS to high level languages such as FORTRAN and Pascal, no other microcomputer disk systems manufacturer provides the range and quality of development and application programs available from Percom."

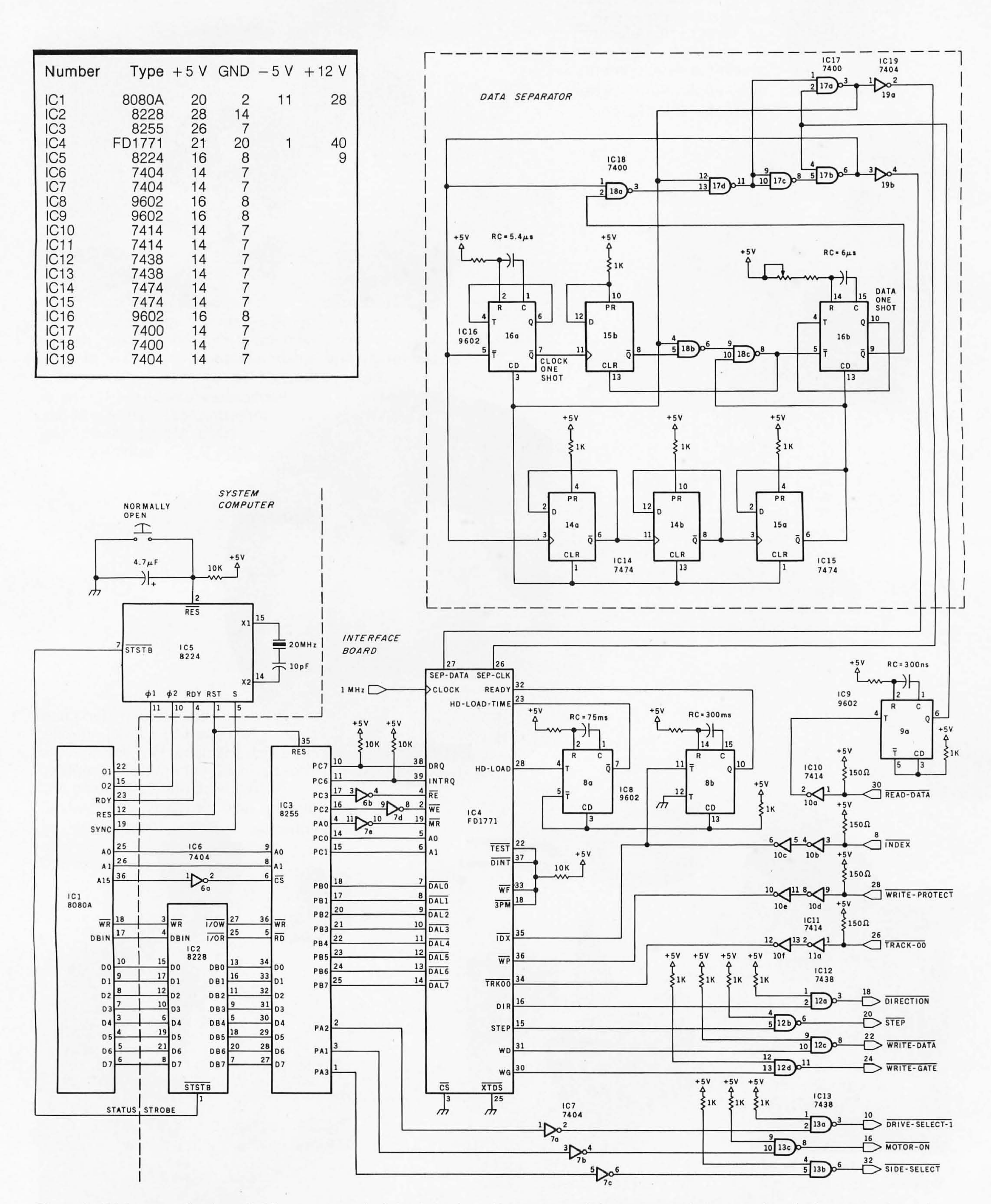


"Connie is running a 'cats eye' test on a mini-disk drive to check radial track alignment. Drive motor-speed timing and sensor alignment tests have already been performed. Disk formatting and format verification tests are next. These measurements are part of the 100% testing every single unit receives."

"Whether you call about a shipping date or ask a tough technical question, you get a competent courteous answer. Outstanding customer service is a hallmark of Percom."

"Richard's making final changes to a disk controller which will allow Percom drives to be used with yet another computer. We're constantly developing and introducing new products that extend and enhance the value of Percom systems."

"Slipping a circuit board through the eye of a needle would be easier than slipping a cold solder joint past Beverly. These are four-drive LFD-400/800 disk system controllers she's inspecting."

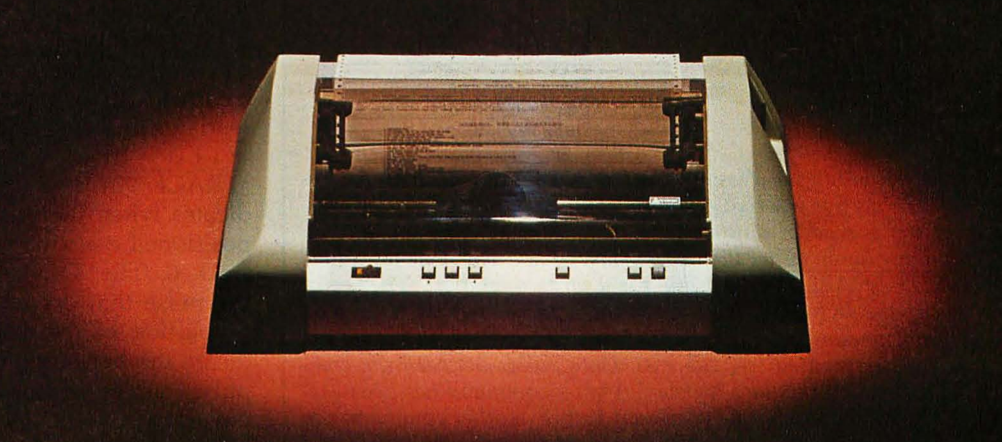


Number	Type	+5 V	GND	−5 V	+12 V
IC1	8080A	20	2	11	28
IC2	8228	28	14		
IC3	8255	26	7		
IC4	FD1771	21	20	1	40
IC5	8224	16	8		9
IC6	7404	14	7		
IC7	7404	14	7		
IC8	9602	16	8		
IC9	9602	16	8		
IC10	7414	14	7		
IC11	7414	14	7		
IC12	7438	14	7		
IC13	7438	14	7		
IC14	7474	14	7		
IC15	7474	14	7		
IC16	9602	16	8		
IC17	7400	14	7		
IC18	7400	14	7		
IC19	7404	14	7		

Figure 2: *Disk-controller board. The circuit to the left of the dotted line is part of the computer being interfaced; the part to the right is the interface to the floppy-disk drive. The area in the dotted box is a data separator made from 7400-series TTL devices. It separates the clock bits from the data bits as they come from the disk drive.*

Meet two new Printers from Anadex:

Resolutionary!



Introducing two totally new line printers from Anadex – Models DP-9500 and DP-9501 – offering 132/158/176 and 132/165/198/220 columns, respectively, and featuring true high-density graphics under direct control of the data source.

Both models employ a rugged, Anadex-built 9-wire print head life-tested to 650 million characters. Combining long life with high resolution, this new head provides dot resolutions of 72 dots/inch vertical and up to 75 dots/inch horizontal.

The full standard ASCII 96 character set, including descenders and underlining of all upper and lower case letters, is printed bi-directionally on the original and up to 5 crisp copies at speeds up to 200 CPS. Print densities are switch- or data-source selectable from 10 up to 16.7 characters/inch, and all can be printed double-width by communications command.

The three ASCII compatible interfaces (parallel, RS-232-C, and Current Loop) are standard in both models; so interfacing is usually a matter of "plug it in and print." Also standard is a sophisticated communications interface providing control of Vertical Spacing (6 or 8 lines/inch), Form Length and Width, Skip-Over Perforation, Auto Line Feed, and full point-to-point communications capability.

Other standard features are: forms width adjustment from 1.75 to 15.6 inches, shortest-distance sensing logic, self-test, quick-change ribbon cartridge with 6 million character life, and a 600 character FIFO buffer. (An additional 2048 character plug-in buffer is optional).

For complete details, quantity discounts and a demonstration, contact Anadex today.



ANADEX, INC. • 9825 DeSoto Avenue • Chatsworth, California 91311, U.S.A. • Telephone: (213) 998-8010 • TWX 910-494-2761

ANADEX, LTD. • Dorna House, Guildford Road • West End, Woking, Surrey GU24 9PW, England • Tel: Chobham (09905) 6333 • Telex: 858762 ANADEX G

Text continued from page 74:
Therefore, it was necessary during the design process to shorten the time for checking the status of the drive. To allow fast status checking, bit 7, the most significant bit, of port C is tied to the FD1771's data-request line (DRQ). The value of the DRQ is brought into the accumulator by performing a memory-access instruction. It is then possible to perform an inclusive-OR of the accumulator with itself (ORA A), which results in the sign bit being set to 1 if there is a data request (ie: if DRQ is high). Based on the status of the sign bit, control can branch to the appropriate routine. This arrangement eliminates the need to perform a separate check on the status bits using one of the logical instructions, thereby saving a significant amount of time.

Interfacing to the SA400

The SA400 drive has connections for twelve transistor-transistor logic (TTL) compatible signal lines. Seven of them connect directly to the FD1771 lines through type-7414 Schmitt-trigger inverters used as line drivers and 7438 open-collector NAND buffers used as line receivers.

The WRITE-DATA line transmits digitized serial data to be written on the floppy disk. The WRITE-GATE signal, when activated, causes the data to be written on the disk. The WRITE-PROTECT line, when active in a low state, indicates that a write-protected disk has been inserted in the drive. The STEP line, when pulsed, causes the read/write head to move radially a distance of one track. The DIRECTION-SELECT line defines the direction that the read/write head moves when the STEP line is pulsed. The TRACK-00 line, when low, indicates when the read/write head is positioned over the outermost track, track 0. The INDEX line transmits the pulse that occurs once for every revolution of the floppy disk to indicate the beginning of a track. (The pulse comes when the index hole passes the photodetector.)

Three drive-select lines, which assign the logical drive address, are connected to port A of the 8255 through 7414 and 7438 circuits used as line drivers and receivers. A MOTOR-ON line, also tied to the 8255, controls the spindle-drive motor. The READ-DATA line is tied to the monostable multivibrator (commonly known as a one-shot) that shortens the pulse width from the drive to 300 ns before sending it to the data separator.

The FD1771 has nine other control lines, which control head positioning and data transfers, but which do not interface directly to the disk drive. Four of the lines to the FD1771 are not used. Lines TEST, DINT, WF and 3PM are therefore tied to +5 V through a 10 k-ohm resistor.

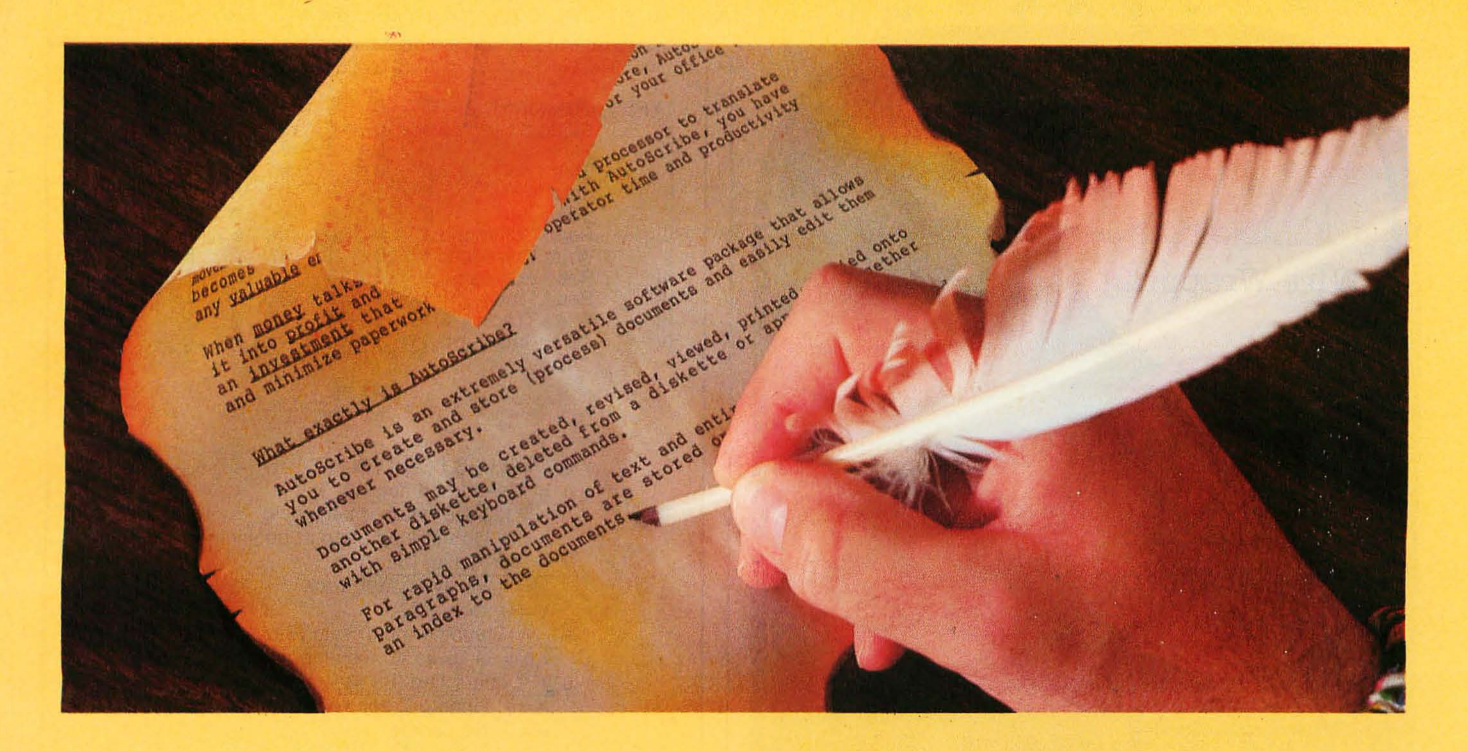
Of the remaining five control lines for the FD1771, the SEPARATED-CLOCK and SEPARATED-DATA lines transmit the clock and data bits from the data separator. (Clock pulses are used in frequency modulated (FM) encoding to signal the beginning of a bit cell.)

The READY line, which signals that the drive is ready for a read or write operation, must be active for the FD1771 to perform any function.

Text continued on page 84

A1	A0	Register Affected During Read ($\overline{RE}$ = 0, $\overline{WE}$ = 1)	Register Affected During Write ($\overline{RE}$ = 1, $\overline{WE}$ = 0)
0	0	Status Register	Command Register
0	1	Track Register	Track Register
1	0	Sector Register	Sector Register
1	1	Data Register	Data Register

Table 1: *Access to registers within the Western Digital FD1771 disk formatter/controller device. The FD1771 has five internal registers: command, data, sector, status, and track. A given register is read or written by placing the appropriate values on lines A1 and A0 and pulling down either the READ-ENABLE (RE) line for a read operation, or the WRITE-ENABLE (WE) line for a write operation. The sector and track registers specify the sector and track when these parameters are needed by a given command byte. The command register, when filled, causes one of eleven high-level instructions to be executed (see table 2). Data passes between the computer and the disk drive through the data register. After a command has been executed by the FD1771, the status register must be read before another command can be executed.*



The Masterpiece Machine

AutoScribe™ and Your MicroComputer

Word Processing Anyone Can Operate. Immediately.

If you've seen other word processing systems, you probably find it hard to imagine. You know other systems require special codes and initials, secret words and annoying pauses, before you can even *think* about creating copy.

AutoScribe is ready to perform at the touch of a key.

With just a handful of simple, logical keyboard commands, the AutoScribe user rapidly learns to create, revise, generate, duplicate, edit, store and retrieve . . . effortlessly and conveniently.

Word Processing That Gets Results

With AutoScribe, every document is a masterpiece . . . justified columns, letter-perfect correspondence, reports that impart the impact of a discerning professional.

Performance? Global search and replace, block move and copy, infinite reverse scroll, page numbering, mailing list merge for customized letters, complete format flexibility . . . the traits of the most advanced state-of-the-art in word processing are standard features of AutoScribe.

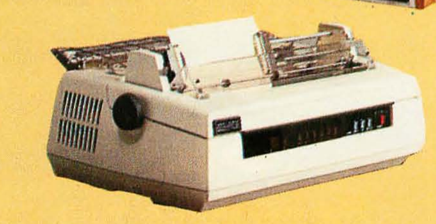
AutoScribe puts word processing in Proper Perspective

Word processing should be an efficient, cost-effective business tool . . . not a mysterious and cumbersome operation requiring weeks of training and highly specialized, expensive hardware.

Supported by lucid, self-teaching documentation, AutoScribe makes your general-purpose microcomputer into an easy-to-use but sophisticated word processor to efficiently complement your other business applications.

Make Your Micro Into a Masterpiece Machine

Put AutoScribe to work in your business operations. Now available for CP/M operating systems and Zenith-Heath systems, as well as double-density NorthStar systems. AutoScribe is also available as a complete turnkey system, including: fast Z80 processor with dual ports and two disk drives for double-density and quad-density floppy disk storage, letter-quality printer, and professional text-editing videoterminal.



AutoScribe™

MICROSOURCE T.M.

See your MicroSource™ dealer for other powerful, user-oriented applications software: LedgerPlus™-the company bookkeeper, Bookkeeper™ — the office accountant, MoneyBelt™ — the money manager, TimeKeeper™ — the time accountant. For the MicroSource dealer nearest you, call (602) 894-9247, and ask for Customer Service. Or write us at 1425 W. 12th Pl., Tempe, AZ 85281.

TYPE	COMMAND	BITS 7	6	5	4	3	2	1	0
I	Restore	0	0	0	0	h	V	r_1	r_0
I	Seek	0	0	0	1	h	V	r_1	r_0
I	Step	0	0	1	u	h	V	r_1	r_0
I	Step In	0	1	0	u	h	V	r_1	r_0
I	Step Out	0	1	1	u	h	V	r_1	r_0
II	Read Command	1	0	0	m	b	E	0	0
II	Write Command	1	0	1	m	b	E	a_1	a_0
III	Read Address	1	1	0	0	0	1	0	0
III	Read Track	1	1	1	0	0	1	0	$\overline{s}$
III	Write Track	1	1	1	1	0	1	0	0
IV	Force Interrupt	1	1	0	1	I_3	I_2	I_1	I_0

(a)

BIT VALUES FOR TYPE 1

h = Head Load flag (Bit 3)
- h = 1, Load head at beginning
- h = 0, Do not load head at beginning

V = Verify flag (Bit 2)
- V = 1, Verify on last track
- V = 0, No verify

$r_1 r_0$ = Stepping motor rate (Bits 1 thru 0)
- $r_1 r_0$ = 11 gives 40 ms step time

u = Update flag (Bit 4)
- u = 1, Update Track register
- u = 0, No update

(b)

BIT VALUES FOR TYPE II

m = Multiple Record flag (Bit 4)
- m = 0, Single record
- m = 1, Multiple records

b = Block length flag (Bit 3)
- b = 1, IBM format (128 to 1024 bytes)
- b = 0, Non-IBM format (16 to 4096 bytes)

$a_1 a_0$ = Data Address Mark (Bits 1 thru 0)
- $a_1 a_0$ = 00, FB (Data Mark)
- $a_1 a_0$ = 01, FA (User defined)
- $a_1 a_0$ = 10, F9 (User defined)
- $a_1 a_0$ = 11, F8 (Deleted Data Mark)

(c)

BIT VALUES FOR TYPE III

$\overline{s}$ = Synchronize flag (Bit 0)
- $\overline{s}$ = 0, Synchronize to Address Mark
- $\overline{s}$ = 1, Do not synchronize to Address Mark

(d)

BIT VALUES FOR TYPE IV

I_0 thru I_3 = Interrupt Condition flags (Bits 3 thru 0)
- I_0 = 1, Not Ready to Ready transition
- I_1 = 1, Ready to Not Ready transition
- I_2 = 1, Index pulse
- I_3 = 1, Immediate interrupt

E = Enable HLD and 10 ms Delay
- E = 1, Enable HLD, HLT and 10 ms delay
- E = 0, Head is assumed engaged and there is no 10 ms delay.

(e)

Table 2: *The high-level instructions of the FD 1771 disk formatter/controller device. When one of the instructions as defined by table 2a is loaded into the command register of the FD1771, the FD1771 executes one or a series of actions. Bits represented by a letter within a command are defined in the bit value tables for that type instruction, tables 2b thru 2e.*

Text continued from page 80:

Since the Shugart SA400 floppy-disk drive has no "ready" signal, the drive's index signal is used to determine a ready condition.

The disk drive transmits the index pulse only when the drive door is closed, the disk is inserted, and the spindle motor is turning. Because the index pulse is transmitted once for each rotation of the disk, the speed of rotation may be determined by measuring the interval between pulses. When the drive spindle has reached final speed, the index pulse is transmitted at intervals of 200 ms.

I used the index pulse to trigger a monostable multivibrator, which generates a one-shot pulse with a length slightly greater than 200 ms. When the drive is up to speed, the one-shot is continuously activated, since the index pulse retriggers it at 200 ms intervals. This one-shot pulse is connected to the ready line on the FD1771, and the derived "ready" signal remains true as long as the drive is ready.

The HEAD-LOAD and HEAD-LOAD-TIME lines are related in function. When the FD1771 issues a command to the drive, the drive may have to first load the head. The head-load time for a Shugart SA400 drive is 75 ms. Since the FD1771 is designed for use with drives having a shorter head-load time, a time-out signal to indicate that the head is loaded must be generated externally. To insure that the head is loaded, the HEAD-LOAD signal from the FD1771 is tied to a monostable multivibrator having a pulse duration of 75 ms. The output is fed back to the FD1771 as its HEAD-LOAD-TIME input to force the FD1771 to wait for 75 ms before sending a read or write command to the drive.

The FD1771 controls the floppy-disk drive with one of several 8-bit command words; these command words are high-level in the sense that each initiates a series of operations that define the function requested. Generally, each command requires some type of parameter. So, before the 8080A microprocessor sends a command, it must first load the necessary parameter in the form of an 8-bit byte into the appropriate register of the FD1771, whether the destination is the data, sector, or track register.

To place the necessary data in a register, address lines A0 and A1 are set according to the data in table 1, the $\overline{\text{READ-ENABLE}}$ ($\overline{\text{RE}}$) line is held high and the $\overline{\text{WRITE-ENABLE}}$ ($\overline{\text{WE}}$) line is pulled low. To implement a command, lines A0 and A1 must address the command register. An 8-bit byte representing the appropriate command is placed on the data lines of the FD1771 (via the B port of the 8255) and is sent to the command register as the $\overline{\text{WRITE-ENABLE}}$ line is toggled from high to low.

FD1771 Commands

The FD1771 recognizes eleven high-level commands; these are illustrated in table 2 with their binary representations. They can be divided into four types. Type I commands are used to move the drive's read/write head. Type II commands are read- and write-sector commands. Type III commands are read-address, read-track and write-track or formatting

commands. Type IV includes a class of command that raises the FD1771 interrupt line on a given condition.

The *restore* command causes the addressed drive to move the head to (or *seek*) track 0. When the *seek* command is executed, the addressed disk drive positions the read/write head over the track specified by the 8080A. The *step* command causes the drive to step the head one track in the direction previously selected. The *step-in* command causes the head to step one track toward track 35, the innermost track. With the *step-out* command, the head steps one track toward track 0.

A *read* command transfers a full sector of data, 1 byte at a time, from the disk to the 8080A. A *write* command transfers data for one sector from the microprocessor to the drive. A *read-track* command transfers all bytes of data on a track to the microprocessor. A *read-address* command transfers the next-encountered identification (ID) field to the microprocessor, places the sector address into the sector register, and checks the 2-byte cyclic-redundancy-check (CRC) field. During a *write-track* (format) command, the microprocessor must supply all gap, ID-field, and data bytes except for address marks and CRC bytes.

Data transfers between the 8080A and the floppy-disk drive can be performed using either direct memory access (DMA) or programmed I/O, both of which are supported by the FD1771. I chose programmed I/O, because it is the simpler method of the two, and because it is fast enough for single-density disk drives. With single-density recording, 1 byte is transferred every 64 μs. An average 8080A instruction takes 5 to 6 μs to execute, so that about ten instructions can be executed during the transfer time. This is enough time to gather the data and perform the required housekeeping functions.

Initializing the FD1771

Before the FD1771 can execute commands, it must be initialized. The program shown in listing 1 sets up the control ports of the 8255 PPI so that port A controls certain aspects of disk selection (as well as the $\overline{\text{MASTER-RESET}}$ ($\overline{\text{MR}}$) pin of the FD1771); port B transmits the command, data, and status words for communication between the 8255 and the FD1771; and port C controls data exchanges between the two devices. All commands and parameters come from the computer to the FD1771 through port B of the 8255. All data and status information from the disk to the computer uses the same path.

Data transfers can be performed with either direct memory access (DMA) or programmed input/output.

The initialization routine of listing 1 also checks the status of the FD1771 and initializes all the registers. The stack pointer is set to memory location hexadecimal 0BEF. For large applications, code for a disk-file library could be established in this routine as well.

Formatting the Disk

Formatting the disk is a matter of loading the track-address register with the point at which formatting is to begin, issuing the seek command which moves the head to that location, loading the data register with the format values, and issuing the write-track command to place that format on the disk.

Assuming that the formatting is to begin at track 0 on the disk, for example, a seek routine (such as the one given in listing 2) is executed. First, the seek routine places the track address (which is 0) on port B of the 8255. Then, holding line A0 high and A1 low (see table 1), the routine causes a write operation to the FD1771 to take place by holding the $\overline{\text{READ-ENABLE}}$ line ($\overline{\text{RE}}$) high and pulling the $\overline{\text{WRITE-ENABLE}}$ line ($\overline{\text{WE}}$) low. (See line 2 of table 1.) Similarly, the command code for a seek operation (hexadecimal 10) is placed on port B of the 8255 and is deposited into the command register of the FD1771 by holding both A0 and A1 low and causing a write operation to take place. When the FD1771 receives the command byte, it executes the seek command, ending with the read/write head in position over the appropriate track (here, track 0).

At the end of the operation, the FD1771 automatically raises the logic state on the interrupt line. At the same time, a byte of status information that indicates whether the command operation was successful is made available to the 8080A. Although the byte of status information does not *have* to be interpreted, the status register *must* be read before another operation can be performed. This is the purpose of the code marked "status handshake" in listing 2.

To format each track, the write-track command must be issued. This is done by placing the command byte for the write-track command (hexadecimal F4) on port B of the 8255, setting lines A0 and A1 low, and strobing the write-enable line with a high-to-low transition. Once this command is received, the FD1771 waits for an index pulse from the disk. The data register must then be filled with the contents of the entire track, 1 byte at a time. At the end of the track the disk drive sends the next index pulse, which causes an interrupt. To write the next track, a seek-to-track-1 operation is performed and another write-track command is issued.

Floppy Disk Format

Although the FD1771 permits non-IBM data-storage formats, I chose to use a modified version of the standard IBM format illustrated in figure 3. This is a 16-sector-per-track, 128-byte-per-sector format. In other words, each of the thirty-five tracks of the floppy disk contains sixteen records (see figure 3).

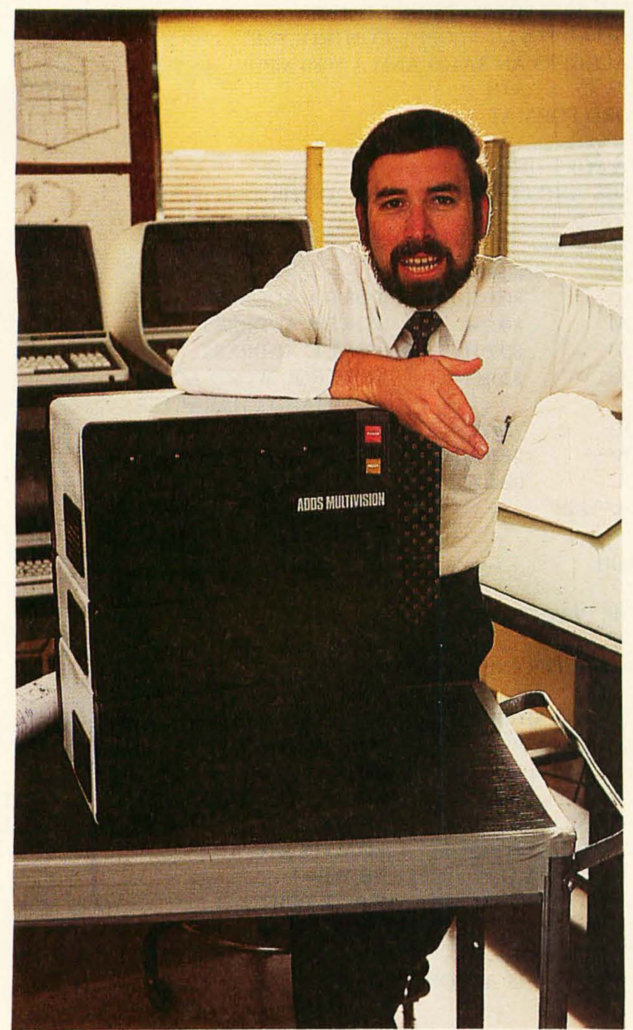
Each track starts with a gap, called G1, of 16 bytes, each containing the value hexadecimal FF. Next come sixteen records, each of which contains an identification (ID) field, a second gap (G2), a data field of 128 bytes, and an inter-record gap, G3, of 26 bytes. The track is finished with approximately 101 bytes of a final G4A gap field.

A 6-byte synchronization, or sync, section begins the identification field and is included to insure that the data separator is in phase with the data. The single-byte address mark (abbreviated as AM) field contains a unique character that defines the beginning of the ID2 section; here, it has a value of hexadecimal FE. The ID2 section

Text continued on page 100

"INTRODUCING THE HOTTEST THING OFF THE DRAWING BOARDS: A COMPUTER TRIO THAT TAKES YOU FROM SMALL TO BIG."

Geof Karlin
Director of Systems Development



If you're considering your first computing system, you need to know more than what it will do for you today. You need to know what it will do tomorrow.

Many businesses outgrow their first computer within a year or two. And when they do, they find their system is difficult if not impossible to add onto–because adding on requires a different manufacturer's equipment, different operating system, different programming languages.

At ADDS, we've just solved this problem with Multivision, a compact trio of stacking computers with ADDS' CP/M®–compatible, multi-user operating system. You can begin with one and expand as needed.

MULTIVISION 1 (top module) is a get-started computer with 5 MHz processor, 64K bytes of RAM (Random Access Memory) and floppy-disk storage capacity of 700K bytes. It's available with a wide range of business application software. We even offer our own word processing package. A fully loaded Multivision 1 is list-priced at $3,785 without terminal.

MULTIVISION 2 (top and bottom modules) uses the new Winchester technology to provide 5M or 10M additional bytes of hard-disk storage. List-priced at $7,995 for 5M bytes of disk, it is thousands less than other hard-disk systems.

MULTIVISION 3 (entire stack) turns your computer into a multi-user system with up to 256K bytes of RAM that supports up to four display terminals. It allows four different parts of your business–i.e., accounting, marketing, purchasing, and shipping–to share data and simultaneously use the system. No other microsystem offers so much for so little.

Before you decide upon any small computer, look into ADDS Multivision. For years we've been the largest supplier of display terminals to computer giants.

Now we're making a system for *you.*

For information, write: Systems Division, Applied Digital Data Systems Inc., 100 Marcus Boulevard, Hauppauge, N.Y. 11787. Dealer inquiries invited.

CP/M is a registered trademark of Digital Research, Inc.

ADDS

ADDS
Applied Digital Data Systems Inc.
SOMETHING EXTRA IN EVERYTHING WE DO

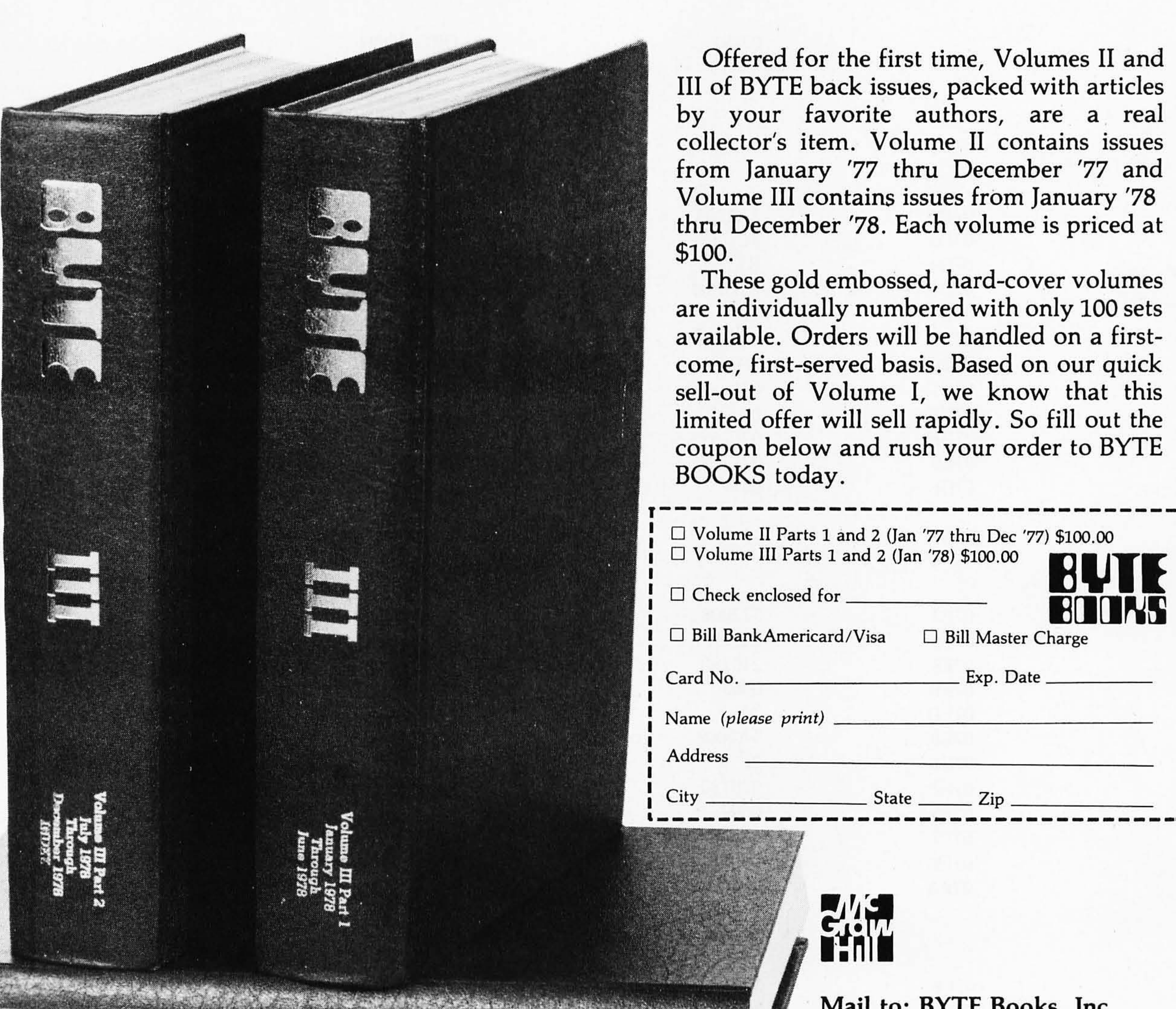
MULTIVISION

Circle 50 on inquiry card.

Listing 1: *Program header and initialization routines. This routine initializes the 8255 programmable peripheral interface and sets the read/write head in the floppy-disk drive to track 0.*

```
Hexadecimal   Hexadecimal   Label    Instruction       Commentary
Address       Code                   Mnemonic
                                     and Operand
                            ; INIT
                            ;
                            ;THIS PROGRAM IS DESIGNED TO PERFORM SEEKS,
                            ;READS, WRITES AND FORMATS USING THE
                            ;WESTERN DIGITAL FD1771 FLOPPY CONTROLLER
                            ;CHIP INTERFACED TO AN SA400 AND A 8080 MPU
                            CTRL     EQU       91H
0091                        ;CONTROL WORD FORMAT:
                            ;MODE=0
                            ;PORTA=DATA PORT (INPUTS)
                            ;PORTB=STATUS AND COMMAND LINES (OUTPUTS)
                            ;PORTC=INPUTS, 0-3
                            ;PORTC=OUTPUTS, 4-7
                            PORTA    EQU       8000H
8000                        PORTB    EQU       8001H       ;PORT A ADDRESS
8001                        PORTC    EQU       8002H       ;PORT B ADDRESS
8002                        CWR      EQU       8003H       ;PORT C ADDRESS
8003                        CHARS    EQU       520H        ;CONTROL WORD ADDRESS
0520                                                       ;COMMAND CHARACTERS
                            SEEK     EQU       7D0H         ENTERED VIA CONSOLE
07D0                        READ     EQU       0B10H       ;SEEK TRACK ROUTINE
0B10                        WRITE    EQU       0B80H       ;READ SECTOR ROUTINE
0B80                        PIN      EQU 798H              ;WRITE SECTOR ROUTINE
0798                                                       ;PORT B SET AS INPUTS
                                  ORG 600H                  ROUTINE
              0600          ;
                            ;INITIALIZE THE PPI (POWER UP)
                            ;
                            ;MR ALWAYS=1 AFTER INITIALIZATION
                            ;
                            INIT             LXI SP,0BFFH  ;SET THE STACK
0600          31FF0B                         CALL PIN      ;PORTB INPUTS
0603          CD9807                         LXI H,PORTA   ;PORTA ADRS
0606          210080                         MVI A,01H     ;MR=0,DR SEL,MOT ON     PPI
0609          3E01                           MOV M,A       ;WRITE PORTA            INITIALIZE
060B          77                             LXI D,PORTC   ;LOAD PORTC ADRS
060C          110280                         MVI A,O       ;RE,WE=1
060F          3E00                           STAX D        ;WRITE PORTC
0611          12            ;
                            ;PPI INITIALIZATION DONE
                            ;RESTORE TO TRACK 0 IS AUTOMATIC
                            ;
                            TRK0
0612          3E00                           MVI A,00H     ;MR=1
0614          77                             MOV M,A       ;WRITE PORTA
0615          3E08                           MVI A,08H     ;READ ENAB-STAT REG
0617          12                             STAX D        ;(RE=0) WRITE PORTC
0618          3A0180                         LDA PORTB     ;READ PORTB—GET
                                                            STATUS
061B          4F                             MOV C,A       ;SAVE STAT REG
061C          3E00                           MVI A,00H     ;RE=1 (MR,WE=1)
061E          12                             STAX D        ;WRITE PORTC
061F          79                             MOV A,C       ;MOV STATUS TO A
0620          E604                           ANI 4H        ;GET TRAK 0 STATUS
0622          FE04                           CPI 4H        ;TRAK 0?
0624          CA1206                         JZ TRKO       ;NO
                            ;
                            ;DRIVE NOW AT TRACK 0 — TEST READY
                            ;
0627          79                             MOV A,C       ;RESTOR STATUS IN A
0628          E680                           ANI 80H       ;GET READY STATUS
062A          FE80                           CPI 80H       ;READY?
062C          CA3506                         JZ INTERP     ;YES GO TO IDLE LOOP
062F          010000                         LXI B,OH      ;ERROR CODE
0632          CD0007                         CALL ERROR
```

LIMITED EDITION



Offered for the first time, Volumes II and III of BYTE back issues, packed with articles by your favorite authors, are a real collector's item. Volume II contains issues from January '77 thru December '77 and Volume III contains issues from January '78 thru December '78. Each volume is priced at $100.

These gold embossed, hard-cover volumes are individually numbered with only 100 sets available. Orders will be handled on a first-come, first-served basis. Based on our quick sell-out of Volume I, we know that this limited offer will sell rapidly. So fill out the coupon below and rush your order to BYTE BOOKS today.

☐ Volume II Parts 1 and 2 (Jan '77 thru Dec '77) $100.00
☐ Volume III Parts 1 and 2 (Jan '78) $100.00

BYTE BOOKS

☐ Check enclosed for ______________

☐ Bill BankAmericard/Visa ☐ Bill Master Charge

Card No. ______________________ Exp. Date ____________

Name *(please print)* ______________________________

Address ______________________________________

City ______________ State _____ Zip ____________

McGraw-Hill

Mail to: BYTE Books, Inc.
70 Main Street
Peterborough N.H. 03458

Listing 2: *Seek routine. This routine causes the read/write head to go to (or seek) the track specified by a 2-digit number entered from the system console.*

Hexadecimal Address	Hexadecimal Code	Label	Instruction Mnemonic and Operand	Commentary
		;THIS ROUTINE IS DESIGNED TO SEEK THE		
		;DRIVE TO A TRACK SPECIFIED BY THE 3RD & 4TH		
		;CHARACTERS ENTERED BY AN OPERATOR.		
	8000	PORTA	EQU 8000H	;PORT A ADDRESS
	8001	PORTB	EQU 8001H	;PORT B ADDRESS
	8002	PORTC	EQU 8002H	;PORT C ADDRESS
	0793	POUT	EQU 793H	;PORT B SET AS OUTPUTS ROUTINE
	0798	PIN	EQU 798H	;PORT B SET AS INPUTS ROUTINE
	0769	STATUS	EQU 769H	;ROUTINE, CONVERTS STATUS TO ASCII PRINTABLE DATA
	0520	CHARS	EQU 0520H	;COMMAND CHARACTERS ENTERED VIA CONSOLE.
		;		
	07D0		ORG 7D0H	;
		;		
		;		
		;FORM THE TRACK ADDRESS FROM THE 3RD & 4TH		
		;CHARACTERS. 4TH CHARACTER MIGHT BE NEGATIVE		
		;IF ONLY ONE CHAR WAS ENTERED.		
		;		
07D0	2A2205	SEEK	LHLD CHARS+2	;GET BOTH CHARS
07D3	7C		MOV A,H	;XFR LS CHAR
07D4	B7		ORA A	;TERM ?
07D5	F2DC07		JP TWO	;NO
07D8	7D		MOV A,L	;LOAD SINGLE CHAR
07D9	C3E207		JMP NEWTRK	;YES
07DC	7D	TWO	MOV A,L	;XFR MS CHAR
07DD	07		RLC	;SHIFT TO MS POSITION
07DE	07		RLC	
07DF	07		RLC	
07E0	07		RLC	
07E1	84		ADD H	;MERGE CHARS
		;NOW PUT NEW TRACK ADDRESS IN FDC DATA REGISTER		
		;		
07E2	322008	NEWTRK	STA TRACK	;SAVE TRACK ADDRESS
07E5	CD9307		CALL POUT	;PORTB=OUTPUTS
07E8	210280		LXI H,PORTC	;GET PORT C ADRS
07EB	0603		MVI B,03H	;A0,A1=1
07ED	70		MOV M,B	;WRITE PORTC
07EE	3A2008		LDA TRACK	;TRAK ADRS
07F1	2F		CMA	;INVERT FOR WD BUS
07F2	320180		STA PORTB	;WRITE PORTB
07F5	0607		MVI B,07H	;WRITE TO DATA REG
07F7	70		MOV M,B	;WRITE PORTC
07F8	0600		B,00H	
07FA	70		MOV M,B	;WRITE PORTC
		;		
		;INITIATE SEEK COMMAND		
		;		
07FB	3E1F		MVI A,1FH	;SEEK 40 MS STEP
07FD	2F		CMA	
07FE	320180		STA PORTB	;WRITE PORTB
0801	0604		MVI B,04H	;WRITE TO CMD REG
0803	70		MOV M,B	;WRITE PORTC
0804	0600		MVI B,00H	;RE,WE = 1
0806	70		MOV M,B	;WRITE PORTC
		;		
		;WAIT FOR END OF SEEK — THEN REPORT STATUS		
		;		

COMMAND HANDSHAKE (bracketing lines 07E2 through 0806)

Listing 2 continued on page 92

MICROSOFT. NOBODY DOES IT BETTER.

In 1975, Microsoft wrote the first BASIC interpreter for the 8080. Today, hundreds of thousands of microcomputers run with Microsoft software. And tomorrow—a full line of system software for the 8086 and Z8000. With microcomputer software, nobody does it better.

BASIC Compiler Microsoft's BASIC compiler is the ideal software tool for the development of BASIC applications programs for resale. Compiled object code for any application may be distributed to your customers on diskette or ROM, thus safeguarding the source program. And execution speeds with our compiled BASIC code are faster than with any other BASIC. Highly optimized, compact object code means maximum efficiency in any application. The BASIC Compiler supports all the language features of our BASIC-80 Interpreter. Comes with macro assembler and loader. Runs with CP/M, ISIS-II, TRSDOS. $395.

BASIC Interpreters for 8080, Z80, 8086, 6800, 6809 Language features above and beyond any other BASIC have made Microsoft's BASIC the world's most popular interpreter. And now three new versions are available for the 8086, 6800, and 6809. The latest releases of BASIC-80 and BASIC-86 support the new WHILE conditional, plus CHAINing of programs with COMMON variables, dynamic string space allocation and variable length records in random files. All versions have double precision arithmetic, full PRINT USING, tracing, renumbering, edit mode, and many other features. BASIC-80 for CP/M, ISIS-II, TEKDOS: $350. BASIC-86 standalone on SBC 86/12: $600. BASIC-68 for FLEX: $200. BASIC-69 for FLEX: $250.

COBOL-80 Compiler The best implementation of the world's most widely used programming language is COBOL-80 from Microsoft. As small business applications become not-so-small, COBOL-80 is ready with powerful use of disk files, data manipulation facilities, CHAIN, segmentation and interactive ACCEPT/DISPLAY. Plus three-dimensional arrays, full COPY facility, indexed and relative files and an optional packed decimal format that saves on mass storage by as much as 40%. Comes with macro assembler and loader. Runs on CP/M, ISIS-II, and TRSDOS. $750.

NEW! muSIMP/muMATH-79 At last, a sophisticated math package for microcomputers. muMATH performs mathematical operations efficiently and accurately. Use it to solve equations and simplify formulas; or perform exact arithmetic, symbolic integration and differentiation, infinite precision integer arithmetic and symbolic matrix inversion. muMATH is an invaluable tool for engineering and scientific applications involving lengthy, analytical computations. It is also an ingenious teaching method for all levels of math from arithmetic to calculus. muMATH is implemented in muSIMP, a highly structured language for complex symbolic manipulations. muSIMP/muMATH Package, CP/M versions: $250.

NEW! muLISP-79 LISP—the lingua franca of the artificial intelligence world—is now available in this efficient, low-cost version for microcomputers. Features include dynamic allocation of storage resources; program control structures such as an extended COND and a multiple exit LOOP; user functions defined as CALL by Value or CALL by Name; and 83 LISP functions. muLISP-79, CP/M version: $200.

NEW! XMACRO-86 For the development of 8086 programs, our new XMACRO-86 cross assembler has just been released. It supports the same features as our MACRO-80 assembler. Develop 8086 programs now on your current CP/M, ISIS-II, or TEKDOS system. $300.

NEW! Micro-SEED DBMS If you are developing applications software in-house or bundling hardware and software for resale, a database manager could be the software tool you've been looking for. Micro-SEED is the first CODASYL compatible database management system to run with CP/M; and Microsoft's FORTRAN-80 has been implemented as the host language. When an application becomes limited by traditional floppy disk file handling, but remains overpowered by the cost and maintenance of a minicomputer, the solution is Micro-SEED. $900.

FORTRAN-80 Compiler Microsoft FORTRAN-80 is the most complete microcomputer FORTRAN available. It has all of ANSI-66 FORTRAN (except COMPLEX data), plus unique enhancements for use in the microcomputer environment. An extensive library of single and double precision scientific functions, too. Comes with macro assembler and loader. Versions for CP/M, ISIS-II, TEKDOS. $500.

MACRO-80 Assembler The most powerful microcomputer assembler on the market today is Microsoft's MACRO-80. It is fast, and it supports Intel-standard macros, relocation pseudo-ops, conditionals and listing controls. MACRO-80 comes with a relocatable linking loader and runs with CP/M, ISIS-II, and TEKDOS. $200.

EDIT-80 Text Editor Random access to floppy disk files makes EDIT-80 the fastest microcomputer text editor. It's the essential tool for creating and maintaining all files. EDIT-80 includes FILCOM, a file compare utility. EDIT-80, CP/M version: $120.

Prices quoted are USA domestic only. OEMs should contact Microsoft for prices.

MICROSOFT ▼ / OS ►	CP/M	ISIS-II	TRSDOS	TRSDOS Md II	TEKDOS
BASIC-80 INTERPRETER	●	●	■	■	●
BASIC COMPILER	●	●	□	●	
FORTRAN-80 COMPILER	●	●	□	■	●
COBOL-80 COMPILER	●	●		●	
muMATH/muSIMP muLISP	●		□		
MICROSEED DBMS	●				
EDIT-80 TEXT EDITOR	●		□	■	
MACRO-80 ASSEMBLER	●	●	□	■	●

● contact Microsoft ■ contact Manufacturer
□ contact Microsoft Consumer Products



10800 NE 8th, Suite 819
Bellevue, WA 98004
206-455-8080 Telex 328945

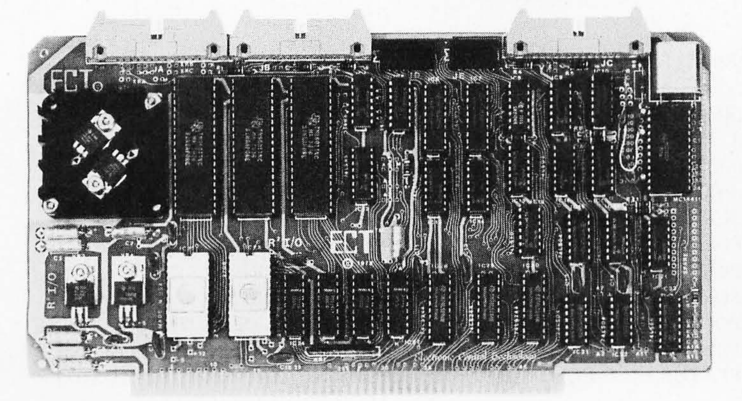


We set the standard.

Listing 2 continued:

```
0807    CD9807           CALL PIN
080A    7E        WAIT   MOV A,M       ;WAIT FOR END OF SEEK   }
080B    E640             ANI 40H                               }
080D    CA0A08           JZ WAIT                               }
0810    3E08             MVI A,08H     ;STAT REG READ          } STATUS
0812    77               MOV M,A       ;WRITE PORTC            } HANDSHAKE
0813    3A0180           LDA PORTB     ;BRING STATUS           }
0816    0600             MVI B,00H     ;RE,WE=1                }
0818    70               MOV M,B       ;WRITE PORT B
0819    2F               CMA           ;INVERT
081A    E618             ANI 18H       ;SEEK AND CRC BITS
                  ;
081C    CD6907           CALL          ;REPORT TO CONSOLE
                         STATUS
081F    C9               RET
                  ;
0820    00        TRACK  BYTE 0
        07D0             END SEEK
```

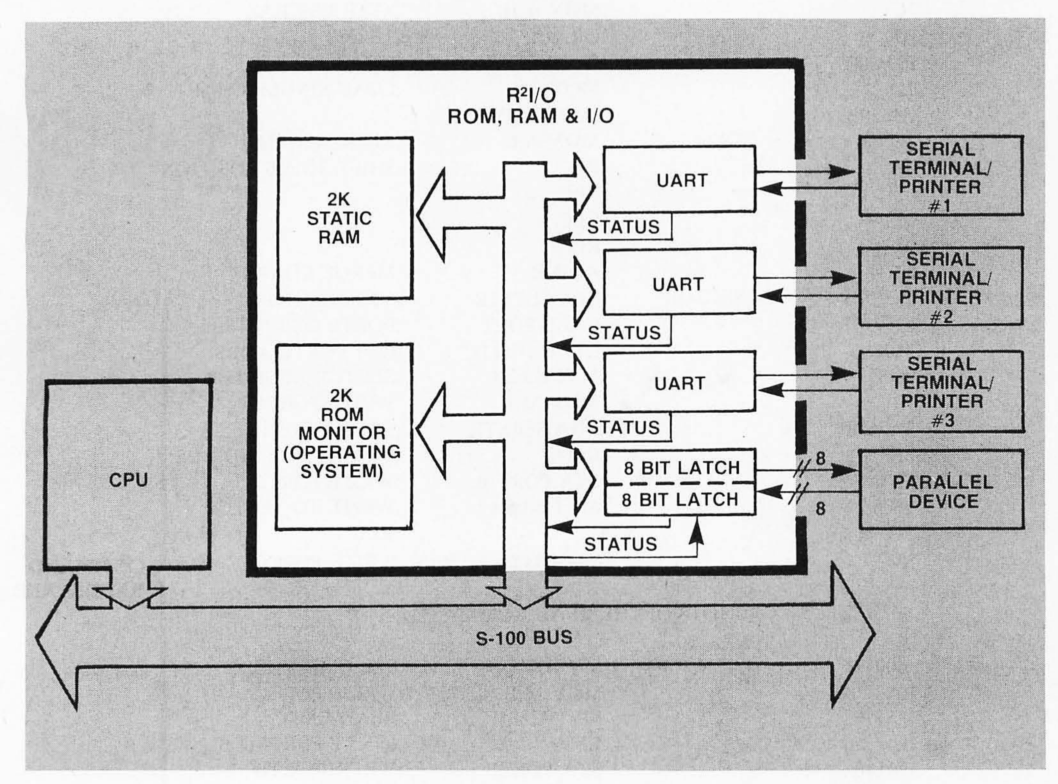
ECT R²I/O... The S-100 ROM, RAM & I/O Board



- S-100 BUS
- 3 Serial I/O Ports
- 2K ROM
- 1 Parallel I/O Port
- 2K RAM
- 4 Status Ports
- ROM Monitor (Operating System)

ELECTRONIC CONTROL TECHNOLOGY's R²I/O is an S-100 Bus I/O Board with 3 Serial I/O Ports (UART's), 1 Parallel I/O Port, 4 Status Ports, 2K of ROM with Monitor Program and 2K of Static RAM. The R²I/O provides a convenient means of interfacing several I/O devices, such as – CRT terminals, line printers, modems or other devices, to an S-100 Bus Microcomputer or dedicated controller. It also provides for convenient Microcomputer system control from a terminal keyboard with the 8080 Apple ROM monitor containing 26 Executive Commands and I/O routines. It can be used in dedicated control applications to produce a system with as few as two boards, since the R²I/O contains ROM, RAM and I/O.

The standard configuration has the Monitor ROM located at F000 Hex with the RAM at F800 Hex and the I/O occupies the first block of 8 ports. Jumper areas provide flexibility to change these locations, within reason, as well as allow the use of ROM's other than the 2708 (e.g. 2716 or similar 24 pin devices). Baud rates are individually selectable from 75 to 9600. Voltage levels of the Serial I/O Ports are RS-232.



8080 APPLE MONITOR COMMANDS

A – Assign I/O
B – Branch to user routine A-Z
C – Undefined
D – Display memory on console in Hex
E – End of file tag for Hex dumps
F – Fill memory with a constant
G – GOTO an address with breakpoints
H – Hex math sum & difference
I – User defined
J – Non-destructive memory test
K – User defined
L – Load a binary format file
M – Move memory block to another address
N – Nulls leader/trailer
O – User defined
P – Put ASCII into memory
Q – Query I/O ports: QI (N)-read I/O; QO(N,V)-send I/O
R – Read a Hex file with checksum
S – Substitute/examine memory in Hex
T – Types the contents of memory in ASCII equivalent
U – Unload memory in Binary format
V – Verify memory block against another memory block
W – Write a checksummed Hex file
X – Examine/modify CPU registers
Y – 'Yes there' search for 'N' Bytes in memory
Z – 'Z END' address of last R/W memory location

ECT™

Specializing in Quality Microcomputer Hardware
Building Blocks for Microcomputer Systems, Control and Test Equipment
Card Cages, Power Supplies, Mainframes, CPU's, Memory, I/O

ELECTRONIC CONTROL TECHNOLOGY **(201) 686-8080**

763 Ramsey Ave., Hillside, N.J. 07205

Listing 3: *Read-sector routine. This routine causes the contents of a given sector of the current track (specified by a 2-digit number entered from the system console) to be transferred from the disk drive to an area of memory starting at the location given by the value of DATBUF, using decreasing memory addresses.*

```
Hexadecimal  Hexadecimal  Label    Instruction     Commentary
Address      Code                  Mnemonic
                                   and Operand

                          ;READ READ SECTOR ROUTINE
                          ;
                          ;READ SECTOR ROUTINE INITIATES THE READ
                          ;COMMAND AND TRANSFERS ALL THE DATA FOR A
                          ;SELECTED SECTOR TO THE BOTTOM OF MEMORY
                          ;BEGINNING AT LOCATION 5FF
                          ;R,XX READ SECTOR, SECTOR ADRS
             8000         PORTA    EQU 8000H       ;PORT A ADDRESS
             8001         PORTB    EQU 8001H       ;PORT B ADDRESS
             8002         PORTC    EQU 8002H       ;PORT C ADDRESS
             0793         POUT     EQU 793H        ;PORT B SET AS OUTPUTS ROUTINE
             0798         PIN      EQU 798H        ;PORT B SET AS INPUTS ROUTINE
             0769         STATUS   EQU 769H        ;ROUTINE CONVERTS STATUS TO
                                                    ASCII PRINTABLE DATA
             05FF         DATBUF   EQU 5FFH        ;BEGINNING ADRS OF "READ"
                                                    DATA BUFFER
             0520         CHARS    EQU 520H        ;COMMAND CHARACTERS ENTERED
                                                    VIA CONSOLE
                          ;
             0B10                  ORG 0B10H
                          ;
0B10         2A2205       READ     LHLD CHARS+2    ;GET BOTH CHARS
0B13         7C                    MOV A,H         ;XFER LS CHAR
0B14         B7                    ORA A           ;TERM?
0B15         F21C0B                JP TWO          ;NO
0B18         7D                    MOV A,L         ;LOAD SINGLE CHAR
0B19         C3220B                JMP SECTOR
0B1C         7D           TWO      MOV A,L         ;XFER MS CHAR
0B1D         07                    RLC             ;SHIFT TO MS POSITION
0B1E         07                    RLC
0B1F         07                    RLC
0B20         07                    RLC
0B21         84                    ADD H           ;MERGE CHARS
0B22         327C0B       SECTOR   STA SECSTR      ;STOR SECTOR          }
0B25         CD9307                CALL POUT       ;PORTB OUTPUTS        }
0B28         210280                LXI H,PORTC     ;GET PORTC ADRS       }
0B2B         0602                  MVI B,02H       ;SECTOR REGISTER      }
0B2D         70                    MOV M,B         ;WRITE PORTC          }
0B2E         3A7C0B                LDA SECSTR      ;SECTOR ADRS          }
0B31         2F                    CMA             ;INVERT FOR WD BUS    }
0B32         320180                STA PORT B      ;WRITE PORTB          }
0B35         0606                  MVI B,06H       ;WRITE TO SECTOR      }
                                                    REG                  }
0B37         70                    MOV M,B         ;WRITE PORTC          } COMMAND
                          ;                                              } HANDSHAKE
                          ;INITIATE THE READ COMMAND                     }
                          ;                                              }
0B38         0600                  MV B,0          ;SEL CMD REG          }
0B3A         70                    MOV M,B         ;WRITE PORTC          }
0B3B         3E88                  MVI A,88H       ;READ CMD             }
0B3D         2F                    CMA             ;INVRT FOR WD BUS     }
0B3E         320180                STA PORTB       ;WRITE PORTB          }
0B41         0604                  MVI B,04H       ;ISSUE READ TO        }
                                                    CMD REG              }
0B43         70                    MOV M,B         ;WRITE PORTC          }

                          ;
                          ;WAIT FOR END OF READ — THEN REPORT
                          ;
```

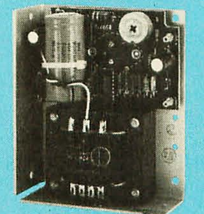
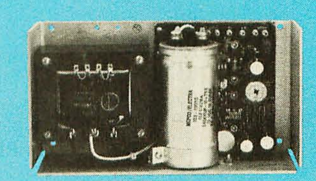
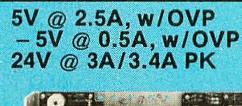
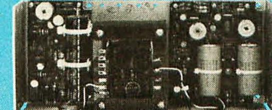
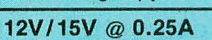
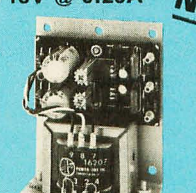
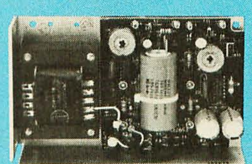
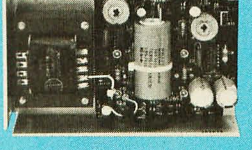
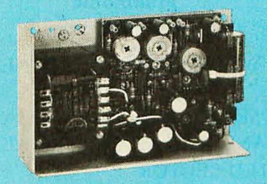
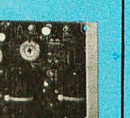
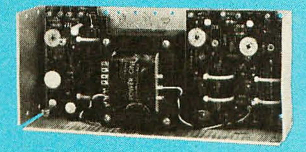
Listing 3 continued on page 96

POWER-ONE D.C. POWER SUPPLIES

Now available for small systems applications

Power-One, the leader in quality open-frame power supplies, now offers a complete line of single, dual, and triple output models for small computer systems. Also available are special purpose models for Floppy Disk and Microcomputer applications.

Below are just a few popular examples of the over 90 "off the shelf" models now available from stock.

SINGLE OUTPUT & LOGIC POWER SUPPLIES • 56 "off the shelf" models • 2V to 250V, 0.1A to 40A • ±.05% regulation • 115/230 VAC input	**5V @ 3A, w/OVP**  HB5-3/OVP $24.95 single qty.	**5V @ 12A, w/OVP**  HD5-12/OVP $79.95 single qty.	**5V @ 40A, w/OVP** **NEW** SK5-40/OVP Switching Model $250.00 single qty.
FLOPPY-DISK SERIES • 8 "off the shelf" models • Powers most popular drives • Single/dual drive applications • 2-year warranty	**5V @ 0.7A, w/OVP** **NEW** **12V @ 1.1A/1.7A PK** CP340 For one 5.25" Media Drive $44.95 single qty.	**5V @ 1A, w/OVP** **−5V @ 0.5A, w/OVP** **24V @ 1.5A/1.7A PK** CP205 For one 8.0" Media Drive $69.95 single qty.	**5V @ 2.5A, w/OVP** **−5V @ 0.5A, w/OVP** **24V @ 3A/3.4A PK**   CP206 For two 8.0" Media Drives $91.95 single qty.
DUAL OUTPUT MODELS • 15 "off the shelf" models • ±5V to ±24V, 0.25A to 6A • I.C. regulated • Full rated to +50°C	**12V/15V @ 0.25A** **NEW**    HAD12-.25/HAD15-.25 $32.95 single qty.	**5V @ 2A, w/OVP** **9 – 15V @ 0.5A**   HAA512 $44.95 single qty.	**±12V @ 1.7A or** **±15V @ 1.5A**  HBB15-1.5 $49.95 single qty.
TRIPLE OUTPUT MODELS • 10 "off the shelf" models • 5V plus ± 9V to ± 15V outputs • Models from 16W to 150W • Industry standard size	**5V @ 2A, w/OVP** **± 9V to ± 15V @ 0.4A**  HTAA-16W $49.95 single qty.	**5V @ 3A, w/OVP** **±12V @ 1A or** **±15V @ 0.8A**  HBAA-40W $69.95 single qty.	**5V @ 6A, w/OVP** **±12V @ 1.7A or** **±15V @ 1.5A**  HCBB-75W $91.95 single qty.



NEW 80' CATALOG!

Get Your FREE Copy Now!

Phone us direct or circle the reader service number below.




Power One Drive • Camarillo, CA 93010 • (805) 484-2806 • TWX 910-336-1297

Circle 55 on inquiry card.

Listing 3 continued:

```
0B44    0603                MVI B,03H       ;SEL DATA REG        }
0B46    70                  MOV M,B         ;WRITE PORTC         }
0B47    CD9807              CALL PIN        ;PORTB = INPUTS      }
0B4A    11FF05              LXI D,DATBUF    ;FWA OF DATA         }
0B4D    0603                MVI B,03H       ;RE,WE=1             }
0B4F    C35C0B              JMP DLOOP                            }
0B52    3E0B      GD        MVI A,0BH       ;RE=0                }
0B54    77                  MOV M,A         ;WRITE PORTC         }
0B55    3A0180              LDA PORTB       ;GET DATA            } DATA
0B58    2F                  CMA             ;INVERT DATA         } TRANSFER
0B59    12                  STAX D          ;SAVE IT             } SEQUENCE
0B5A    1B                  DCX D           ;BUMP INDEX          }
0B5B    70                  MOV M,B         ;RE=1,PORTC          }
0B5C    7E        DLOOP     MOV A,M         ;GET STATUS          }
                                             PORTC               }
0B5D    B7                  ORA A           ;DRQ=1?              }
0B5E    FA520B              JM GD           ;YES                 }
0B61    E640                ANI 40H         ;INTRQ SET?          }
0B63    CA5C0B              JX DLOOP        ;NO                  }
                  ;
                  ;READ DONE — GET STATUS
                  ;
0B66    3E00                MVI A,O         ;ADRS STAT REG       }
0B68    77                  MOV M,A         ;WRITE PORTC         }
0B69    3E08                MVI A,08H       ;STROBE RE=0         }
0B6B    77                  MOV M,A         ;WRITE PORTC         }
0B6C    EB                  XCHG                                 } STATUS
0B6D    227E0B              SHLD ISAVE      ;SAVE INDEX TO       } HANDSHAKE
                                             DATA                }
0B70    EB                  XCHG            ;RESTOR PORTC        }
                                             ADRS                }
0B71    3A0180              LDA PORTB       ;GET STAT BYTE       }
0B74    0600                MVI B,0         ;STAT HANDSHAKE      }
0B76    70                  MOV M,B         ;WRITE PORTC
0B77    2F                  CMA             ;INVERT STAT
                                             BYTE
0B78    CD6907              CALL STATUS     ;REPORT STATUS
0B7B    C9                  RET
                  ;
0B7C    0000      SECSTR    WORD 0          ;SECTOR ADRS
0B7E    0000      ISAVE     WORD 0          ;DATA INDEX
                                             STORAGE AREA
        0B10                END READ
```

Listing 4: *Write-sector routine. This routine causes a section of memory to be written to a given sector on the disk. The sector number is specified by a 2-digit number entered from the system console.*

```
Hexadecimal  Hexadecimal  Label  Instruction     Commentary
Address      Code                Mnemonic
                                 and Operand
                  ;WRITE WRITE SECTOR ROUTINE
                  ;
                  ;WRITE SECTOR ROUTINE INITIATES THE WRITE
                  ;COMMAND AND TRANSFERS ALL THE DATA FOR A
                  ;SELECTED SECTOR
                  ;
                  ;W,XX = WRITE SECTOR,SECTOR ADRS
8000    PORTA               EQU 8000H       ;PORT A ADRS
8001    PORTB               EQU 8001H       ;PORT B ADRS
8002    PORTC               EQU 8002H       ;PORT C ADRS
0793    POUT                EQU 793H        ;PORT B SET AS
                                             OUTPUTS
                                             ROUTINE
0798    PIN                 EQU 798H        ;PORT B SET AS
                                             INPUTS ROUTINE
0769    STATUS              EQU 769H        ;ROUTINE
                                             CONVERTS
                                             STATUS TO ASCII
                                             PRINTABLE DATA
0520    CHARS               EQU 520H        ;COMMAND CHAR-
```

Listing 4 continued on page 98

MicroQuote

Your personal computer becomes a window on Wall Street.

MicroNET, the personal computer service of CompuServe, now offers MicroQuote, a comprehensive securities information system.

With MicroQuote you can gain information from a data bank of over 32,000 stocks, bonds and options from the New York, American, OTC and major regional markets plus Chicago options. MicroQuote contains price and volume data from January, 1974 with cumulative adjustment factors and dividend information from January, 1968.

You can determine indicated annual dividends, earnings per share, shares outstanding, BETA factors, open interest on options and amount outstanding on debt issues. MicroQuote can provide issue histories on a daily, weekly or monthly basis and even performs certain statistical analyses on the data. It's a vital tool for any investor.

It's just part of the MicroNET service

MicroNET also allows error-free downloading of software via the new software exchange and executive programs (now available for the TRS-80,® Apple II® and CP/M® systems). It also provides electronic mail service and can be accessed with a 300 baud modem via local phone calls in more than 175 U.S. cities. Write for full details on how your microcomputer can control one of the nation's largest and most sophisticated time-sharing computer centers for about 8 cents a minute!

TRS-80 is a registered trademark of Tandy Corporation
Apple II is a registered trademark of Apple Computer, Inc.
CP/M is a registered trademark of Digital Research

Regional distributors and local dealers wanted. Inquire to Dept. R

Software authors: MicroNET seeks to license quality programs for software exchange. Write to Dept. S



Mail to: CompuServe
Dept: B
Personal Computing Division
5000 Arlington Centre Blvd.
Columbus, Ohio 43220

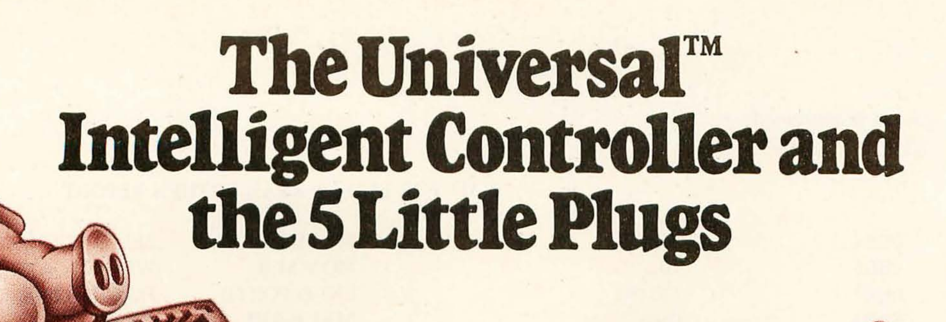
Circle 56 on inquiry card.

Listing 4 continued:

```
                                                     ACTERS ENTERED
                                                     VIA CONSOLE
                              ;
             0B80                         ORG 0B80H
                              ;
0B80         2A2205           READ        LHLD CHARS     ;GET BOTH CHARS
                                          +2
0B83         7C                           MOV A,H        ;XFER LS CHAR
0B84         B7                           ORA A          ;TERM?
0B85         F28C0B                       JP TWO         ;NO
0B88         7D                           MOV A,L        ;LOAD SINGLE
                                                          CHAR
0B89         C3920B                       JMP SECTOR
0B8C         7D               TWO         MOV A,L        ;XFER MS CHAR
0B8D         07                           RLC            ;SHIFT TO MS
                                                          POSITION
0B8E         07                           RLC
0B8F         07                           RLC
0B90         07                           RLC
0B91         84                           ADD H          ;MERGE CHARS
0B92         32E50B           SECTOR      STA SECSTR     ;STOR SECTOR
0B95         CD9307                       CALL POUT      ;PORTB OUTPUTS
0B98         210280                       LXI H,PORTC    ;GET PORTC ADRS
0B9B         0602                         MVI B,02H      ;SECTOR
                                                          REGISTER
0B9D         70                           MOV M,B        ;WRITE PORTC
0B9E         3AE50B                       LDA SECSTR     ;SECTOR ADRS
0BA1         2F                           CMA            ;INVERT FOR WD
                                                          BUS
0BA2         320180                       STA PORTB      ;WRITE PORTB
0BA5         0606                         MVI B,06H      :WRITE TO
                                                          SECTOR REG
0BA7         70                           MOV M,B        ;WRITE PORTC
                              ;
                              ;INITIATE THE READ COMMAND
                              ;
0BA8         0600                         MVI B,O        ;SEL CMD REG
0BAA         70                           MOV M,B        ;WRITE PORTC
0BAB         3EA8                         MVI A,0A8H     ;WRITE CMD
0BAD         2F                           CMA            ;INVRT FOR WD
                                                          BUS
0BAE         320180                       STA PORTB      ;WRITE PORTB
0BB1         0604                         MVI B,04H      ;ISSUE READ TO
                                                          CMD REG
0BB3         70                           MOV M,B        ;WRITE PORTC
```

COMMAND HANDSHAKE

Listing 4 continued on page 100



This little pluggy
went to the S-100,
This little pluggy
stayed with fixed disks,
This little pluggy
had floppies,
This little pluggy
supported tape,
And this little pluggy
went all the way home,
to the Universal™ Controller.

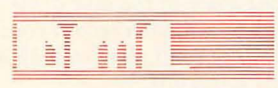
PIERAZZI

Five plug sets is all it takes for simultaneous, multi-device storage control. DML's Universal™ Intelligent Controller makes it possible.

- S-100 Bus, with CP/M* support
- Plug adaptable device support
- Control of up to 8 storage devices: 4 fixed disks, 4 floppy or tape cartridge drives
- IEEE DMA or port transfer

Call or write for full information. Data Management Labs, 2148 Bering Drive, San Jose, CA 95131 (408) 248-2104.

*CP/M is a trademark of Digital Research



DATA MANAGEMENT LABS

Circle 58 on inquiry card.

Listing 4 continued:

```
                         WAIT FOR END OF READ — THEN REPORT

0BB4   0603                     MVI B,03H      ;SEL DATA REG      }
0BB6   70                       MOV M,B        ;WRITE PORTC       }
0BB7   110180                   LXI D,PORTB    ;PORTB ADRS        }
0BBA   0603                     MVI B,03H      ;RE,WE=1           }
0BBC   C3C70B                   JMP DLOOP                         }
0BBF   3E8D           GD        MVI A,8DH      ;LOAD DATA         }
0BC1   2F                       CMA            ;INVRT DATA        } DATA
0BC2   12                       STAX D         ;WRITE PORT B      } TRANSFER
0BC3   3E07                     MVI A,07H      ;WE=0              } HANDSHAKE
0BC5   77                       MOV M,A        ;WRITE PORTC ·     }
0BC6   70                       MOV M,B        ;RE=1,PORTC        }
0BC7   7E             DLOOP     MOV A,M        ;GET STATUS        }
                                                PORTC             }
0BC8   B7                       ORA A          ;DRQ=1             }
0BC9   FABF0B                   JM GD          ;YES               }
0BCC   E640                     ANI 40H        ;INTERQ SET        }
0BCE   CAC70B                   JZ DLOOP       ;NO                }
                         READ DONE — GET STATUS

0BD1   CD9807                   CALL PIN       ;PORTB INPUTS      }
0BD4   3E00                     MVI A,0        ;ADRS STAT REG     }
0BD6   77                       MOV M,A        ;WRITE PORTC       }
0BD7   3E08                     MVI A,08H      ;STROBE RE=0       } STATUS
0BD9   77                       MOV M,A        ;WRITE PORTC       } HANDSHAKE
0BDA   3A0180                   LDA PORTB      ;GET STAT BYTE     }
0BDD   0600                     MVI B,0        ;STAT HANDSHAKE    }
0BDF   70                       MOV M,B        ;WRITE PORTC       }
0BE0   2F                       CMA            ;INVERT STAT
                                                BYTE
0BE1   CD6907                   CALL STATUS    ;REPORT STATUS
0BE4   C9                       RET

0BE5   0000           SECSTR    WORD 0         ;SECTOR ADRS
       0B80                     END READ
```

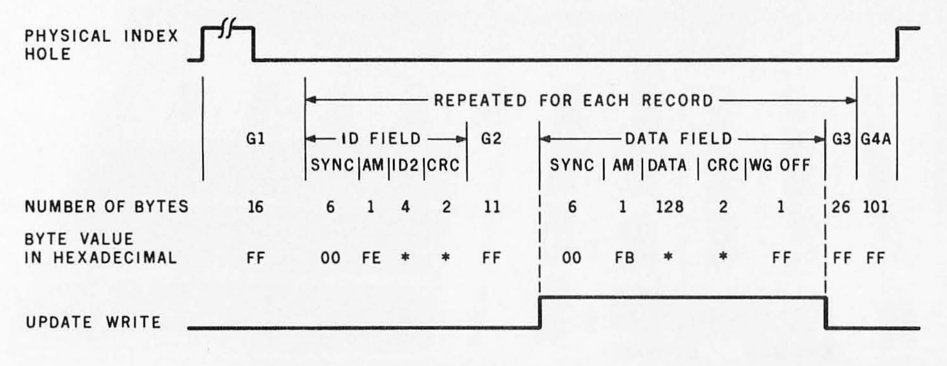


Figure 3: *Format of data as recorded on one track of the disk drive. Each track contains sixteen records, each of which contains 128 bytes. Each record consists of an identification (ID) field followed by a data field. The columns marked with an asterisk represent fields with contents that vary from record to record.*

Text continued from page 86:

contains the following: track address, side-select byte (set to 00 here), sector address, and sector length (set to 00 here because the sector length is constant); each field is 1 byte long. The cyclic-redundancy-check (CRC) section contains a 2-byte value that serves to check the accuracy of the previous bytes as written onto the disk. A command byte of hexadecimal F7 sent to the FD1771 controller causes it to generate and write the CRC bytes.

The data field also begins with a sync section. The address mark for this section, hexadecimal FD, is a different value than for the sync section in the identification field. A data section of 128 bytes follows and can be filled with any desired data. The last section within the data field is the write-gate-off (WG-off) byte, which allows the head an area in which to be

turned off from the write mode without destroying any valid data. Although a hexadecimal FF is written to this field, we do not care what value resides in the WG-off field on the floppy disk.

Once the disk is formatted, reading or writing can begin. The read and write commands are similar in several respects to other commands such as the seek command. Each must be part of a software routine in which a command parameter is loaded into the data, sector, or track register, and the command itself is loaded into the command register. All commands also generate an interrupt signal at their completion. This interrupt must be reset through a status handshake routine that reads the status register.

However, the read and write commands differ from commands like the seek command in the following one respect: data must be transferred. For example, a write command, in a data-transfer routine like that presented in hexadecimal locations 0BB4 thru 0BCE of listing 4, places a byte of data in port B and points the address pointers (lines A0 and A1) to the data register. When the FD1771 raises the DRQ line, the $\overline{\text{WRITE-ENABLE}}$ line is brought low. The byte of data, which is placed in the FD1771 data register, is transferred from the FD1771 to the disk. The 8080A places another byte in the port and pulls the $\overline{\text{WRITE-ENABLE}}$ line low again when the FD1771 signals that it is ready to accept another byte of data. A similar procedure is followed for a read command (see listing 3), except that this command uses the $\overline{\text{READ-ENABLE}}$ line.

This concludes our discussion of the hardware and software necessary to interface a Shugart SA400 disk drive to an 8080A-based microcomputer system. Additional application information is given in the application notes available from the companies listed in the references. ■

References

1. *SA400/450 Minifloppy Diskette Storage Drives with an 8080A/FD1771 Single Density System Application Bulletin*, Shugart Associates, 415 Oakmead Parkway, Sunnyvale CA 94086
2. *FD1771 Floppy Disk Formatter/Controller Data Sheet*, Western Digital Corporation, 3128 Red Hill Ave, POB 2180, Newport Beach CA 92663
3. *Intel 8080 Microcomputer Systems User's Manual*, Intel Corporation, 3065 Bowers Ave, Santa Clara CA 95051

YOU WiN!

programming the 6502

RODNAY ZAKS SYBEX

6502 applications book

RODNAY ZAKS SYBEX

6502 GAMES

rodnay zaks SYBEX

with SYBEX



PROGRAMMING THE 6502

This book is designed as a progressive, step-by-step approach to assembly language programming–with excercises developed to test the reader at every step. Learn to write complete applications programs. Features: Programming and addressing techniques, input/output techniques and devices, application examples, data structures, program development and more.

Ref. C2O2 $12.95

6502 APPLICATIONS BOOK

This title presents real life application techniques for any 6502 based microcomputer board. Programs presented cover building a complete home alarm system, electronic piano, motor speed regulator . . . and more. Learn techniques ranging from simulated traffic control to analog-digital conversion. The KIM-1, SYM-1 and AIM 65 are thoroughly covered.

Ref. D 3O2 $12.95

6502 GAMES

Designed as an educational text on advanced programming techniques, this book presents a comprehensive set of algorithms and programming techniques for common computer games. All of the programs were developed for the 6502 at the assembly language level. Learn how to devise strategies suitable for the solution of complex problems commonly found in games.

Ref. G4O2 $12.95



Please send me ______________ Charge my ____ Visa: ____ Mastercharge

Name ______________ ____ American Express

Company ______________ Card # ______________ Exp. Date ______

Address ______________ Signature ______________

City ________ State ______ Zip ______ ☐ Please send me your detailed catalog.

TO ORDER:

By Phone: (415) 848-8233, Visa, MC, AmEx

By Mail: Indicate quantity desired. Prepayment required

Shipping: Add $1.50 per book (UPS) or 75¢ (4th Class - allow 4 weeks delivery)

Tax: In California please add tax

SYBEX

AVAILABLE AT BOOK AND COMPUTER STORES EVERYWHERE

A Graphics Text Editor for Music

Part 2: Algorithms

Randolph Nelson
2039 West Artesia Blvd
Apt 121
Torrance CA 90504

The Commands

With what commands should the editor provide the user in order to make the program easy to use, and how does the nature of these commands affect the structure of the program?

Mode Commands

We begin to answer this question by distinguishing three major ways in which the user will use the program. The first is when the user creates a score of music. Here the editor must establish a file for the score and allow the user to overwrite the default values for the music, such as the key and time signatures. The second major use consists of editing the score. The program needs to provide facilities for locating the measure to be edited, reformatting the pages after editing, and writing the finished version out to a file. The third and hardest facility the editor must provide is the ability to display the score on the screen.

A multitude of problems must be handled automatically by the editor in adjusting the format of the score as it will appear on the screen. The above discussion leads to a definition of three separate modes of operation for the editor called the CREATE, EDIT, and DISPLAY modes. Switching between modes is done by issuing a command through the graphics tablet as discussed in part 1. The editor also switches modes automatically to display the contents of a measure while the user creates or edits the score.

Location Commands

Commands must be provided to allow sequential passage through the score. In order to do this, the user must first set a symbolic-operation mode which determines the units to be used as increments in moving through the score. These units are pages, lines, measures, or characters, and are set via commands on the template. For example, suppose you are located on page two, line one, measure three, and character twenty-one of the score, and you wish to edit page five, line four, measure one, and character three. The following sequence of commands will accomplish this:

1. Touch page. This sets the increments to pages, and sets the line, measure, and character values to one.
2. Touch forward three times. This positions you on the first line, measure, and character of page five.
3. Touch line. Touch forward three times. You are now at the first measure of line four.
4. Touch character and touch forward two times.

If you are editing the end of a unit, it is often faster to back up. If you were editing the last character, number thirty-seven, of measure one above, you could go to measure two and then back up one character rather than going forward from measure one, thirty-seven times. If the program is to provide this flexible location scheme to the user, it should be easy to determine the location of the page, line, measure, and character at any place in the score. A look back at the data structures indicates that this was accomplished using doubly-linked pointers between the score area arrays.

Edit Commands

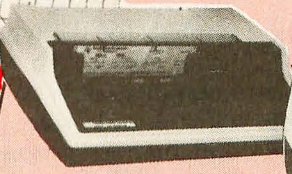
The program must support all editing features that allow easy text manipulation. Commands to insert, delete, replace, or move pages, measures, lines, or characters must be provided, as well as methods of searching the text for patterns of music. These facilities require a set of routines that will automatically adjust the paging of the music after editing.

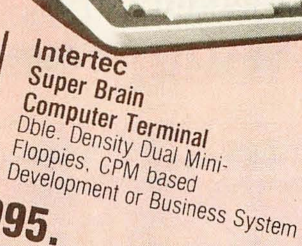
Note
The figure numbering sequence is continued from part 1 which appeared in the April 1980 BYTE.

SYNCHRO-SOUND

The ORIGINAL Computer People
who KNOW Computers
and offer EVERYTHING you need
in Small Computer Systems

A PERFECT SUPER SPECIAL MATCHED PAIR!





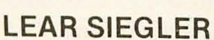
Texas Instrument 810 Multi Copy Impact Printer
150 characters per sec.
bi-directional printing

Intertec Super Brain Computer Terminal
Dble. Density Dual Mini-Floppies, CPM based
Development or Business System

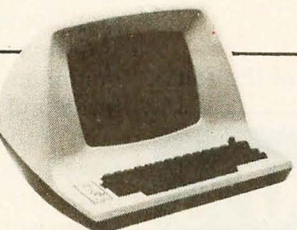
ONLY **$3995.**

TERMINALS





ADDS Regent 25



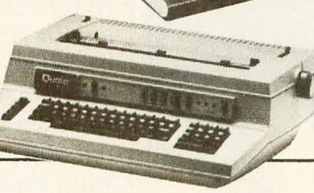
LEAR SIEGLER
ADM 3A
ADM 31
ADM 42



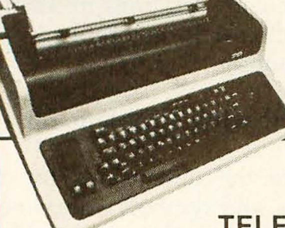
HAZELTINE

1400	1500	Mod 1
1410	1510	Edit
1420	1520	

PRINTERS

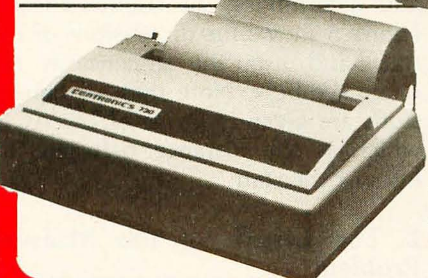


QUME Sprint
5/45 KSR
5/55



DECwriter IV
LA 34

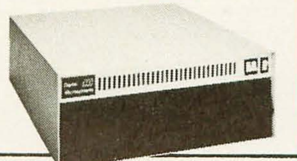
TELETYPE
43



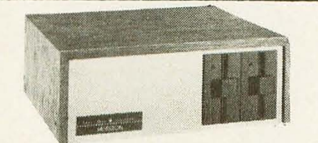
CENTRONICS

779-2	703-0
700-2	730

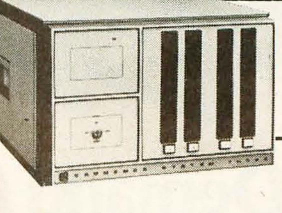
COMPUTERS



DIGITAL SYSTEMS
DSC 2
Dble. Density
Dual Drive Disk



NORTHSTAR
HORIZON II
HORIZON II Quad



CROMEMCO
System 3



ATARI
400
800

MORE SPECIALS

Okidata SL125	$2595.00
Okidata SL300	2995.00
Persci 277	1395.00
Integral Data Systems Paper Tiger Printer	895.00
Imsai PCS 80/15	499.00
Televideo 912, 920	CALL
Livermore Accoustic Coupler	$195.00
Centronics Micro Printer	349.00
5″ Scotch Diskette Box	34.95
8″ Scotch Diskette Box	39.95

MANY OF OUR PRICES ARE TOO LOW TO ADVERTISE. PLEASE CALL OR WRITE

We carry a full line of Alpha-Micro Products.
We have a full staff of Programmers and Computer Consultants to design, configure and deliver a Turnkey Computer System to meet your specific requirements.



SYNCHRO-SOUND ENTERPRISES, INC.
THE COMPUTER PEOPLE
193-25 Jamaica Ave., Jamaica, New York 11423 • TWX 710-582-5886

PHONE ORDERS, CALL:
New York 212/468-7067
Los Angeles-213/628-1808
Chicago-312/641-3010
Dallas-214/742-6090

Circle 61 on inquiry card.

Exit Commands

After editing a measure, the user either wants the version to become a permanent part of the score, or wishes to inform the program to ignore any changes made. This is the function of the EXIT and NULL-EXIT commands on the template. Note that the exit command must transfer the contents of the work area to the score area and make the necessary format changes while the NULL-EXIT simply does nothing.

Symbols

Music abounds with symbols. The template shown in part 1 indicates only a few. The actual design allows for one hundred different symbols. In order to avoid cluttering the template you would have to cull the necessary symbols for the type of music that is being scored. To transfer from one notational style to another is not a difficult task, since only the template and interface program would have to be changed. The main portion of the editor is protected from such alterations.

Output

The hardest problems of the editor are related to displaying the musical score on the screen in a pleasing and useful format. I will touch on three classes of problems, and outline their solutions in this section.

Dimension Problems

This set of problems is caused by the physical dimensions of the screen output. The actual physical dimensions of the height and length of the screen are fixed, and you must work around their limitations. Since most graphics screens represent points in a coordinate system, the maximum and minimum absolute coordinates for the X and Y axis are set.

In order to achieve a flexible design, no commitment should be made to any of these machine-dependent characteristics. Instead, you should work in a virtual coordinate space controlled by the editor, and write another interface program to handle the conversion of coordinates in the virtual space to the actual screen coordinates. Every dimension that is given will then represent a dimension of the virtual space in the editor. Since the option of determining the size of a score of music should be left to the user, you must understand that all dimensions are subject to scaling factors that will be set by the user on entrance to the program. With these considerations in mind, I will now discuss three problems and their solutions.

1. The Spacing Problem for the Staff

How are the dimensions for the staff, notes, and symbols determined? The solution was found by taking measurements from scores of music and determining the standard sizes. Figure 5 shows the dimensions of the staff and lists the dimensions for other symbols. Note that all dimensions are given in terms of LSPACE, which is the distance between the lines of the staff.

2. The Length of the Measure Problem

How do you assign a virtual length to a measure? Although each measure has the same number of beats, their lengths can differ radically. Observe in figure 7 that the length between notes of the same value is not always equal. This eliminates a simple method in which you would assign virtual lengths to specific note values

TRS-80 OWNERS

MAKE PROGRAMMING EASY WITH THE

BALCODE SYSTEM

- OP codes based on IBM 370 BAL.
- Non-primitive BALCODE instructions do the work of six to eight Z-80 instructions.
- Dual macro expanders for flexibility and higher order coding structures.
- Super editor includes copy, move, find and change commands with stop at CRT fill-up.
- •• Editor, assembler, source code and object code all reside in memory at the same time. Edit, assemble and run without dumps or loads.
- •• Fortran equations are permitted.
- Special OP codes for printer and CRT displays.

WHEN ORDERING PLEASE SPECIFY DOS OR CASSETTE SYSTEM.

BALCODE 80—Available now, Super editor, dual macro expanders, BALCODE assembler, user's manual **$69.00**

BALCODE 80A—Available now, same as BALCODE 80, includes 32/56 bit floating point assembler **$79.00**

BALCODE 80B—Available in July 1980. Same as 80A. Allows inclusion of Fortran statements. ($10 to purchasers of 80A). . . . **$89.00**

BALCODE 11—Available in July 1980. Transcendentals and complex variable operations **$15.00**

BALCODE 21—Available in July 1980. Matrix operations, Kalman digital filter, polynomial curve fitting **$75.00**

BALCODE 31—Numerical integration. Gravity and atmospheric models **$49.00**

Additional BALCODE manuals . . . **$15.00**

ALL FUTURE UPGRADES $10.00 TO ORIGINAL PURCHASERS
CHECK, MONEY ORDER, VISA & MASTER CHARGE





The BALCODE SYSTEM is designed to provide a universal assembly language, standard subroutine and macro libraries, and a compiler to permit Fortran equations. The full capability of the Z-80 can now be achieved with the BALCODE SYSTEM.

BALCODE

BALCODE SOFTWARE INC.
P.O. BOX 3750
WOODLAND HILLS, CA 91365
(213) 889-4394

Circle 63 on inquiry card.

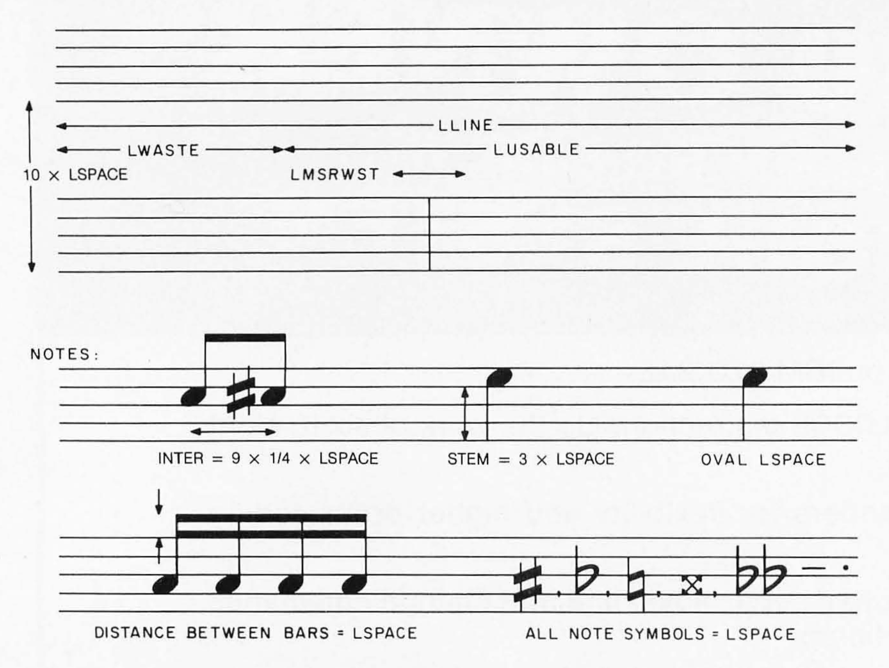


Figure 5: *Dimensions of the musical staff, notes, and symbols. All dimensions are given in terms of LSPACE, the distance between the lines of the staff.*

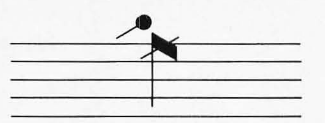
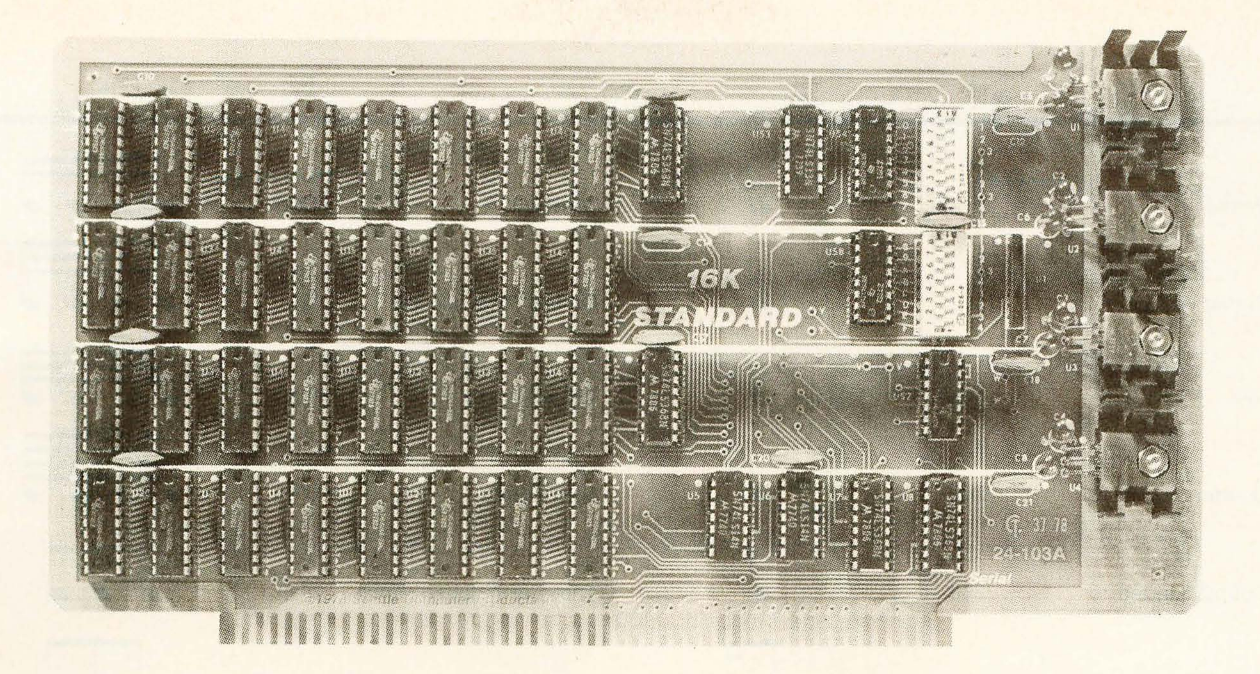


Figure 6: *An example of a rarely occurring musical symbol. Of the many thousands of symbols which are used to communicate different forms of expression, some are used only infrequently. This particular symbol is found in piano music. It directs the performer to reach inside the instrument and strike the string corresponding to the indicated note with a mallet.*

and determine the total length of the measure by summing their values. A modified approach to this simple scheme can be adopted, however. You must first determine the minimum distance between notes that allows sharps and flats to be inserted, while still preserving readability. This distance can be fine-tuned to the eye of the user, but it is approximately nine-fourths the distance between the lines of the staff, or (9/4)×LSPACE. This dimension will be called the *internote distance,* denoted by INTER. Second, a *beaming group* is defined as a set of notes that are connected by beams. Later I will discuss a routine that determines beaming groups in the measure. Assume here that the job has been done. Next, a code for each possible note value is determined (this code was actually developed much earlier and is used throughout the program in most of the data structures). This information is shown in table 5. Notice that all the values are integer quotients of 20160. There are several reasons for this particular encoding scheme. First, the editor allows for twenty-six different note values. In order that the subgroupings of these notes add up to correct total values, each note must have the same common denominator. The value 20160 fulfills the requirement. The code for one beat is 5040. Other reasons for this encoding concern the eventual placement of the notes in their proper screen locations. The total length of the measure is now the sum of the lengths of all of the beaming groups of that measure plus the lengths of the rests. The algorithm for determining the length for the beaming groups can now be stated:

1. Determine the total number of beats for the beaming group. This can be done by summing the codes for all the notes in the group and dividing by 5040, the value for one beat. Let this value be NUM.
2. Find the minimum value for the beaming group. Call this MIN.
3. Determine the number of notes required if the total number of beats were to be taken up by the minimum note. This is simply NUM / MIN.
4. Multiply this number by the internote distance. Thus you finally get the length, which is equal to (NUM / MIN×INTER.

You can now perform the above routine for all of the beaming groups of the measure and sum up the lengths, with rests included. The total value represents the virtual length of



16K RAM Fully Static 300 nsec. for 4 Mhz. Z-80 $265

The Model 24-103 "STANDARD RAM" was designed for the smaller system which does not require bank select. It has been in production since late 1978 and has earned an enviable record for reliability. Although it does not have some of the options of the commercial cards listed below, its manufacturing quality has not been cut in any way. The card has DIP switch addressing — any continuous 16K on 4K boundaries. All inputs are buffered and it comes fully assembled, tested and guaranteed for one year. Prices for the card with 300 nsec. chips start at $265 and drop to $225 for quantities 5-9. Add $30 per board for 250 nsec. chips for faster CPU clock speeds.

OTHER S-100 BUS STATIC RAMS

16K PLUS

This board has been sold primarily to dealers/system integrators during the past 20 months. It has become the reliability standard against which other boards are compared. It is fully static, 16K by 8 bits, and a premium quality product featuring Schmitt triggers for all signal inputs. The board has been optimized for the Cromemco systems using output port 40H for its bank select. It also has start-up options which allow the board to come up in either the enabled or disabled condition. It is addressable by DIP switches in any continuous 16K on 4K boundaries. Prices with 300 nsec. chips (for 4 Mhz. Z-80 systems): 1-4, $365; 5-9, $295. Add $30 per board for 250 nsec. chips for faster CPU clock speeds.

16K APEX

This board is very similar to the PLUS card. It differs in that its bank select can use any of 256 output port addresses and it can be addressed on 16K boundaries only. Pricing is the same as for the PLUS.

8/16 RAM

This board was designed for the 1980s. It is configured as 16K by 8 bits when accessed by an 8-bit processor and configured 8K by 16 bits when used with a 16-bit processor. The configuration switching is automatic and is done by the card sampling the "Sixteen Request" signal sent out by all 16-bit CPU boards. The card has all the high noise immunity features of the PLUS and APEX as well as "extended addressing". Extended addressing is a replacement for bank select which makes use of a total of 24 address lines to give a directly addressable range of over 16 megabytes. (For older systems, a switch will cause the card to ignore the highest 8 address lines) This card ensures that your memory board purchase will not soon be obsoleted. It comes with 200 nsec. memory chips only and is guaranteed to run without wait states with our 8086 CPU using an 8 Mhz. clock. Prices: 1-4, $445; 5-9, $345.

MEMORY CHIPS

We have 4044 type 4K by 1 fully static memory chips available. See our ad in March BYTE for prices.

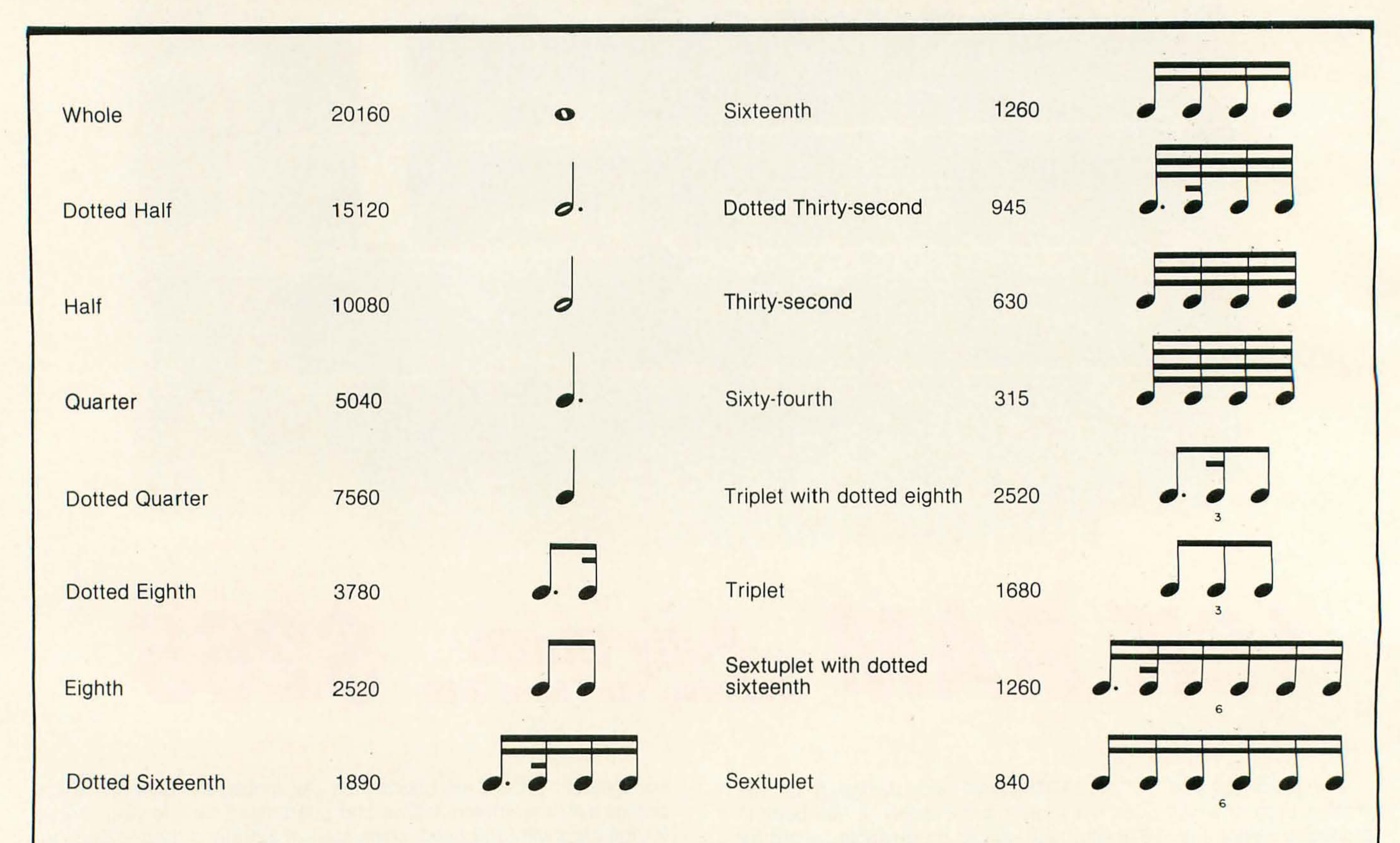
ALL SCP BOARDS ARE FULLY ASSEMBLED, TESTED AND GUARANTEED ONE YEAR

HOW TO ORDER

There are two ways to go. You can check with your local dealer or order directly from the factory. Bank cards, personal checks, CODs okay. There is a 10-day return privilege on factory orders. All boards are guaranteed for one year — both parts and labor. Shipped prepaid by air from stock in US and Canada. Foreign purchases — must be prepaid in US funds. Also add $10 per board for overseas air shipment.



Circle 65 on inquiry card.



Whole	20160	Sixteenth	1260
Dotted Half	15120	Dotted Thirty-second	945
Half	10080	Thirty-second	630
Quarter	5040	Sixty-fourth	315
Dotted Quarter	7560	Triplet with dotted eighth	2520
Dotted Eighth	3780	Triplet	1680
Eighth	2520	Sextuplet with dotted sixteenth	1260
Dotted Sixteenth	1890	Sextuplet	840

Others: Fifth 1008, Seventh 720, Ninth 560, Tenth 504, Eleventh 458, Twelfth 420, Thirteenth 387, Fourteenth 360, Fifteenth 336.

Table 5: *Additional musical symbols.*

the measure. This is stored in the character array of the score area.

3. The Line Length Problem

With different sized measures, how do you determine the number of measures that will fit on each line, thus assuring that the bar lines at the end of each line are aligned? The difficulty of this problem is increased by the fact that not all of the space in a line is used. Each line of music starts with a clef, key signature, and time signature. Every bar line of every measure is bounded by empty space. (Refer to figure 5.) All of these spaces must be accounted for in determining the number of measures that can fit on each line.

Assume that the total length of the line in virtual space is LLINE. The first part of that space must be allocated to the clef and signatures; this will be called LWASTE. The total usable virtual space, LUSABLE, is then equal to LLINE−LWASTE. The wasted space around each measure will be called LMSRWST. If N measures are on the line, then N×LMSRWST space has been wasted in these measures. Now suppose that you are positioned at the first measure that will go on the line. You know the virtual lengths of this measure and all that follow. Denote the sum of the lengths of these first N measures as SUMN. The problem is then to find the largest N such that:

$$LUSABLE \geq SUMN + N \times LMSRWST$$

This says that you want to find the greatest number of measures that can be put on the line before going past the end of the line. In general, the measures will not fit perfectly on the line; therefore there will be excess space at the end. This excess must be distributed equally among the measures, and to do this you must find a scaling factor to transform each X coordinate of the measure into a new coordinate. This scaling factor can be easily determined. Let EXCESS be the excess space at the end of the line. It is equal to LUSABLE − SUMN − N × LMSRWST. The scaling factor then is simply LUSABLE/(LUSABLE − EXCESS). The solution to the line length problem is shown in algorithmic form in listing 1.

Beaming

Before this problem can be formulated I will review some of the questions that must be answered when writing music on the page. These are various conventions used for writing music. The following lists a few of these problems.

Stems Up or Down?

You must first decide if a group of eighth or sixteenth notes will be underbeamed or overbeamed (ie: whether the ligature is placed at the top or bottom of the note stems which point up or down, respectively). The easiest solution to this problem consists in finding the maximum note displacement from the center line of the staff and then drawing the note stems in that direction. There are

several exceptional cases for this simple algorithm. For example, if the previous group of notes was underbeamed and the maximum displacement of the next group is above the middle line of the staff (but not by much), the score will read easier if the group is underbeamed rather than overbeamed.

Determining Beam Inclination

Note in figure 7 that the ligature inclination of beaming groups is not always the same. To determine the angle of the beam, you must find the height difference between the stems of the maximum note and the minimum note. For each octave of this difference, increase the height of the tilt by one unit. Notice that the tilt can be either up or down. In the following discussion I will talk about one of the four cases: underbeamed and tilting upward. The other three cases are easy modifications to the algorithms.

Determining the Stem Lengths

The length of the stems from the notes depends on several factors. Suppose you have an underbeamed, upward-inclined beaming group. The shortest note stem must be at least a certain minimum length for readability. Once this distance is set, determine the lengths of the stems for the other notes of the beaming group. These distances depend on the location of the note and the angle of the beam. Although the algorithms are quite involved, they basically consist of solving equations to find the intersection point for the lines of the stems and the beam. A complete description of an example with all the equations is given in figure 8.

The algorithms for each of these problems are not difficult, and for the most part they consist of only a few instructions. However, the exceptional cases which make the music more readable are complex and tedious. Given the ad hoc nature of musical notation there seems to be no mechanical way to eliminate these exceptional cases. Let me briefly outline the basic algorithms. Once again, you assume that you have a routine that provides the beaming groups and that you are dealing only with an underbeamed upward-inclined group.

The beam-characteristic algorithm is shown in listing 2.

Next I will discuss how to determine the beaming groups. The basic strategy is to collect notes with flags until one either goes past a beat or encounters a rest. Then output a beaming group, and if a rest is encountered, continue within the beat to collect the remaining notes of the beat. Only in cases of syncopated rhythms will beaming groups cross over a beat. I might add that this is the reason for the strange initialization:

BEATCOUNT =
BEATCOUNT + 5040

in step 2 of the algorithm, for if BEATCOUNT comes back negative from step 4, a beat has been crossed over. The algorithm is shown in listing 3.

Symbol Problems

Several ways are presented for routines that draw the notes and symbols on the screen. You must keep in mind that the eventual size of the symbols is left to the discretion of the user, and the program must therefore allow for scaling. Scaling sometimes distorts characters, so the editor must have procedures to keep this distortion within a readable limit. I found that for symbols consisting mostly of straight lines, simply storing a set of relative points and drawing lines between them is sufficient. For symbols that are curves, such as the G clef, a better approach is to use a spline-fitting routine to draw the symbol.

Listing 1: *Solution to the line-length problem in algorithmic form.*

```
1. LUSABLE = LLINE - LWASTE
2. N=1      SUMN=Virtual length of first measure
3. VALUE=SUMN+N×LMSRWST
   IF LUSABLE<VALUE THEN GO TO 4
   N = N +1
   SUMN = SUMN + VALUE of virtual length of Nth measure
   GO TO 3
4. EXCESS = LUSABLE - VALUE
   LSCALE = LUSABLE / (LUSABLE - EXCESS)
5. Store scale into the scale portion of the line array for future use when displaying the
   measure.
```

Listing 2: *Algorithm used to determine whether a group of notes should be under or overbeamed.*

```
1. Find the minimum note in the beaming group. MINX, MINY
   Find the maximum note in the beaming group. MAXX, MAXY
   Let OCTAVE be the height of an octave.
   Let MID be the height of the middle note of the staff.
   Let STEM be the minimum length of a stem.
   Let LENGTH be the virtual length of the beaming group.
2. IF (MAX - MID) ≥ (MID - MIN) then overbeam, ELSE underbeam.
   Assume underbeam.
3. TILT = (MAX - MIN) / OCTAVE (integer division)
4. For each note in beaming group:
   Get coordinates into NOTEX, NOTEY
   M = TILT / LENGTH
   B = (MINY - STEM) - MINX × M
   The height of the stem for this note is then equal to NOTEY - M × NOTEX - B.
```

Listing 3: *Algorithm to determine the beaming groups.*

```
1. BEATCOUNT = 0
   MEASURECOUNT = Number of beats to a measure times 5040.
2. BEATCOUNT = BEATCOUNT + 5040
   IF MEASURE ≤ 0      GO TO 5
3. Get value of next note into NOTEVAL
   BEATCOUNT = BEATCOUNT - NOTEVAL
   MEASURECOUNT = MEASURECOUNT - NOTEVAL
4. IF BEATCOUNT ≤ 0 THEN output group and GO TO 2.
   IF encountered a rest THEN output group and go to 3
5. Finished with measure, either continue or stop.
```

Figure 7: *Sample of a musical score, in this case part of a bourrée by J S Bach. Note the difference in note spacing and in angles of beams.*

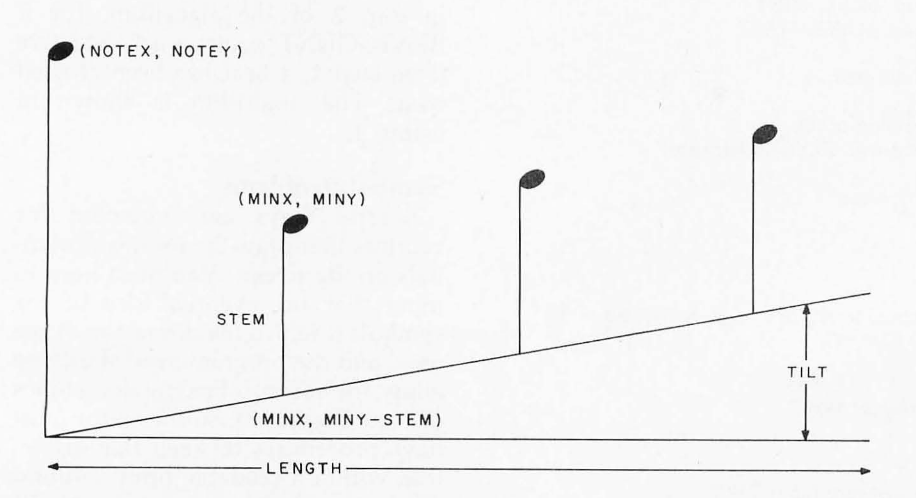


Figure 8: *Calculating the equation of the line segment forming a beam. The standard slope intercept equation $Y = mX + b$ is used. We know that the slope is $M = TILT/LENGTH$, and that the value of one point on the line is $(MINX, MINY-STEM)$. Fitting this to the equation of the line, we can find $b = (MINY-STEM)-M \times MINX$. The heights for all the other stems can then be calculated. For each note, put the X and Y coordinates in NOTEX and NOTEY. The height for this stem is then $HEIGHT = NOTEY-M \times NOTEX-b$.*

Although this requires much more computation time on the computer, it does produce an aesthetically pleasing symbol and allows the user to fine-tune the form of the symbol by simply moving a few of the interpolation points.

Other Points

Now that the basic design of the editor has been presented, I will discuss some of the finer points of the design.

Patterns and Sequences

Although the input format is satisfactory for most music, the use of the current template becomes taxing, if not impossible, when creating a score of complex music. There is no facility that allows the user to input complex rhythms. In order to provide this ability, the concept of a pattern

TODAY MAY BE THE BEST TIME TO MAKE YOUR CAREER MOVE

But first make sure your new employer measures up.

With all of those prospective employers trying to attract your engineering skills, now is the best time to look beyond "just a job" and consider your career. Your real objective is to find the perfect combination—challenge, satisfaction, security, and reward. To assist you, we've prepared a checklist of points to consider when you're evaluating a new employment possibility. It's a good way to compare the companies seeking your expertise.

Career Opportunity Checklist for Engineers

INDUSTRY GROWTH AND STABILITY

No one wants to be "phased out," so check for security: YES ? NO

Is the company part of an industry that's vital, growing, dynamic? .... ☐ ☐ ☐

Will the growth continue throughout the 1980s and beyond? .... ☐ ☐ ☐

COMPANY HISTORY AND REPUTATION

You can tell a lot about a firm by its track record:

Is the company recognized and respected in the industry? .... ☐ ☐ ☐

Have sales and profits increased at a steady rate? .... ☐ ☐ ☐

Is it known for its technological innovations? .... ☐ ☐ ☐

Are its employees motivated and well rewarded? .... ☐ ☐ ☐

Does the company seek technological employees on a permanent, ongoing basis? .... ☐ ☐ ☐

WORKING CONDITIONS AND ENVIRONMENT

Look for good people, team spirit, and top-notch facilities:

Is the atmosphere one of loyalty, pride, and achievement? .... ☐ ☐ ☐

Do employees welcome the challenge of difficult assignments? ...... ☐ ☐ ☐

Are creativity and independent thinking encouraged? .... ☐ ☐ ☐

Are the company's engineering goals clear-cut and attainable? .... ☐ ☐ ☐

THE COMPANY LOCATION

Relocation is a big professional and personal commitment.

Is the company located in an existing or emerging electronics center? .. ☐ ☐ ☐

Are there major universities and other technological resources nearby? . ☐ ☐ ☐

Will the company assist me in relocating? .... ☐ ☐ ☐

Can I provide my family a comfortable lifestyle in this area? .... ☐ ☐ ☐

Are there cultural and entertainment opportunities? .... ☐ ☐ ☐

Is there a variety of recreational and leisuretime activities? .... ☐ ☐ ☐

Are the climate and surroundings pleasant? .... ☐ ☐ ☐

PERSONAL AND PROFESSIONAL GROWTH

Job satisfaction means more than just a paycheck:

Does the company give full recognition to the engineering role? ...... ☐ ☐ ☐

Will I be working and interacting with other talented professionals in my field? .... ☐ ☐ ☐

Will my accomplishments be acknowledged, appreciated, rewarded? .. ☐ ☐ ☐

Will I be encouraged to seek more challenge and responsibility? ...... ☐ ☐ ☐

Will the company pay for advanced training in technology and management? .... ☐ ☐ ☐

Can I pursue my own career goals within the company framework? ... ☐ ☐ ☐

THE LONG RANGE PICTURE

Where will you be professionally in 5 years?...in 10 years?

Are there plenty of opportunities for rapid advancement within the company? .... ☐ ☐ ☐

Does the company encourage engineers to assume positions of authority? ☐ ☐ ☐

Will I be allowed to move into those engineering areas that interest me most? .... ☐ ☐ ☐

Can I choose my own career path—into technological leadership or executive management? .... ☐ ☐ ☐

One Company to Evaluate

At Racal-Milgo, we're looking for capable communications hardware and software people to join our engineering team. Our success has created needs at every level, from entry to top management. We have a lot to offer you.

The mainstream of our business is data communications—where today's action is. We're a pioneer, and a recognized leader in the field. Our state-of-the-art product lines include modems, multiplexers, data encryption, and systems for sophisticated network control and performance assessment.

We're proud of our growth—$64 million in sales two years ago, $80 million last year, and over $100 million this year—and we're still growing. Applied research and technology keep us on the leading edge in data communications; our engineers face some of the industry's most challenging (and rewarding) responsibilities.

Racal-Milgo is a great place to work. We encourage our technical people to think creatively, to turn their innovative ideas into successful products—in an atmosphere of friendly, professional teamwork. We provide them with one of the nation's most advanced engineering facilities. Our salaries and benefit programs are among the best in the business.

We're located in suburban South Florida, one of the growing new electronics centers in the sunbelt. It's an international area, gateway to Latin America, blessed with a pleasant climate year-round. There are excellent cultural and entertainment opportunities, plus swimming, diving, boating, sport fishing, golf, tennis, and all the other benefits of a cosmopolitan resort. There's a wide choice of employee clubs to introduce you and your family to new activities. And if you're interested in furthering your professional or business related education, we'll pay for your coursework at any of the major universities nearby.

At Racal-Milgo, we're experiencing dynamic growth, and we need good people at all levels. The working conditions are excellent...advancement and rewards come fast...and our new two-track career program lets you decide whether to rise to the top on the technical side or to move into management. (Our president and board chairman are both EE's.)

We're looking for the best. If you are too, let's get together. I hope to personally welcome you aboard. Send me your resume today; no letter required. You'll receive a prompt reply.



Ed Hilpert

Ed Hilpert
Vice-President, Engineering

Racal-Milgo™

Racal-Milgo, Inc.
8600 N.W. 41st Street Miami, Fl. 33166

Circle 66 on inquiry card.

HALF	QUARTER	EIGHTH	SIXTEENTH	THIRTY-SECOND	TRIPLET 3	SEXTUPLET 6
DOTTED HALF	DOTTED QUARTER	DOTTED EIGHTH	DOTTED SIXTEENTH	DOTTED THIRTY-SECOND	DOTTED TRIPLET 3	DOTTED SEXTUPLET 6
WHOLE	SIXTY-FOURTH	5TH	7TH	9TH	10TH	11TH
SET	END	DISPLAY	12TH	13TH	14TH	15TH
PAT	1	2	3	4	5	6
SEQ	1	2	3	4	5	6

Figure 9: *Extensions to the musical template for more advanced editing.*

of rhythm is created. Here the user can establish any rhythmic pattern with a code number. When this code number is touched on the template, the interface program organizes the notes which are entered after it according to that rhythm. The template must now have more fields on it to accommodate this ability, and the interface program must be expanded to perform these computations. The extensions to the template are shown in figure 9. In order to create a rhythmic pattern the user must issue the following commands:

1. Push SET and PAT. This informs the interface program that a pattern is to be created.
2. Push a number on the PAT row. This will be the number of the pattern, and any existing pattern with this number is overwritten.
3. Push the series of note values which determines the pattern.
4. Push END. This signifies the end of the pattern.

To use the pattern the user issues the following commands:

1. Push the number of the pattern.
2. Push the pen onto the correct pitch positions on the staff, preceding them with any attached symbols such as sharps, dots, slurs, etc. Note that the order of the notes and symbols is now important, but the X locations on the staff are immaterial.

The end of the pattern occurs when the number of notes of the pattern is pushed onto the screen. If more notes are entered before another pattern number is pushed, the interface program issues a warning to the user signifying that the pattern is ended. If an insufficient number of notes is entered before another command is issued, the user is warned and the incomplete input is discarded.

A sequence, as used here, is simply a series of patterns. Suppose that sequence 1 consists of the patterns 2, 5, 1. The use of sequence 1 will cause the notes pressed to follow the rhythm of pattern 2. When all of its notes are used up, it will follow the rhythm of pattern 5, and when that is finished, it will follow pattern 1. Setting a sequence is similar to the setting of a pattern. The steps are:

1. Push SET and SEQ.
2. Push a number in the SEQ row. This is the sequence number.
3. Push a series of numbers in the PAT or SEQ row.
4. Push END.

Sequences can cross over measures and can consist of other sequences. To clarify these concepts, input the music in figure 7, using patterns and sequences. There are many ways to input that section of score. Break up the rhythms into their smallest components and then form sequences from them. Thus, three patterns are defined first: one consisting of a quarter note only, the other of two eighth notes, and the last of four sixteenth notes. The following commands do this:

1. Push SET, PAT, and 1.
2. Push QUARTER.
3. Push END.

4. Push SET, PAT, and 2.
5. Push EIGHTH twice.
6. Push END.

$10000.00 + PLUS $

SPONSORED BY THE MAKERS OF THE

BASIC SOFTWARE LIBRARY

NOW ★ 10 ★ Volumes and Growing

And unlike others we are giving a portion in CASH that you Don't have to spend with us.

In addition to the $10,000 Give Away we are going to celebrate July 4th by giving a Special Bonus to purchasers of an entire set of the Basic Software Library on a single order.

★ SPECIAL BONUS ★ 15% discounts on single purchase of full set by July 4th, 1980

We have over 100,000 in circulation since 1975 and we are still around and That's more than Anyone else can say. We used to sell hundreds of programs individually, the programs in Volume X were sold for several years at over $10,000, in Volume III for over $6,000 but a few years ago we decided to promote software to the mass public and it was an instant success. We are still several years ahead of our time in our marketing concepts as well as our products and we are going to be making another major change in the market. We are going to offer our programs in cassette form. NOT just one of two programs like everybody else. But a book full of programs for just $9.95.

For Homeowners, Businessmen, Engineers, Hobbyists, Doctors, Lawyers, Men and Women

Vol. I $24.95
Business & Personal Bookkeeping Programs

Bond, Building, Compound, Cyclic, Decision 1, Decision 2, Depreciation, Efficient, Flow, Installment, Interest, Investments, Mortgage, Optimize, Order, Pert Tree, Rate, Return 1, Return 2, Schedule 1

Games & Pictures

Animals Four, Astronaut, Bagel, Bio Cycle, Cannons, Checkers, Craps, Dogfight, Golf, Judy, Line Up, Pony, Roulette, Sky Diver, Tank, Teach Me

A. Newman, J.F.K., Linus, Ms. Santa, Nixon, Noel Noel, Nude, Peace, Policeman, Santa's Sleigh, Snoopy, Virgin

Vol. II $24.95
Binomial, Chi-Sq., Coeff., Confidence 1, Confidence 2, Correlations, Curve, Differences, Dual Plot, Exp-Distri, Least Squares, Paired, Plot, Plotpts, Polynomial Fit, Regression, Stat 1, Stat 2, T-Distribution, Unpaired, Variance 1, Variance 2, XY.

APPENDIX A

Beam, Conv., Filter, Fit, Integration 1, Integration 2, Intensity, Lola, Macro, Max. Min., Navaid, Optical, Planet, PSD, Rand 1, Rand 2, Solve, Sphere Trian, Stars, Track, Triangle, Variable, Vector

Vol. III $39.95
Billing, Inventory, Payroll, Risk, Schedule 2, Shipping, Stocks, Switch

Vol. VI $49.95
Mini-Ledger, Payroll, A/R, Inventory, Peprec., Ledger

Vol. VII $39.95
Chess, Medbil, Wdproc, Utility

Vol. IV $9.95
Bingo, Bonds, Bull, Enterprise, Football, Funds 1, Funds 2, Go-Moku, Jack, Life, Loans, Mazes, Poker, Popul, Profits, Qubic, Rates, Retire, Savings, SBA, Tic-Tac-Toe

Vol. V $9.95
Andy Cap, Baseball, Compare, Confid 10, Descrip, Differ, Engine, Fourier, Horse, Integers, Logic, Playboy, Primes, Probal, Quadrac, Red Baron, Regression 2, Road Runner, Roulette, Santa, Stat 10, Stat 11, Steel, Top, Vary, Xmas

APPENDIX B

Vol. VIII $19.95
1040-Tax, Balance, Checkbook, Instol 78, Deprec 2

APPENDIX C

Favorites

Vol. IX $19.95
Auto, Cypher, Hurrtrac, ID, Lorana, Map, Navigate, Omega, Patterns, Radar, RDF

Vol. X $69.95
Intro., A/R, A/P, Mer Inv, Check, Assets, Payroll, Bal Sh, P/L, Year End, Data Base, Tax Up, Basic St.

Volume III—Part 1—Billing Inv. Pyrl.
Volume VII—Part 1—Chess
—available on TRS-80 level II compatible cassette $9.95
Add $1.00 per tape Post./Handling

Volume VI — Disk programs are compatible with TRS-80 disk basic
The disk programs in Volumes VI, VII and X are written in (CP/M) M Basic and Disk Extended Microsoft Basic. Other programs written in 8K Basic.

SELECTED PROGRAMS AVAILABLE ON CASSETTE



OVER 116,000 IN USE TODAY

Add $1.50 per volume handling, all domestic shipments sent U.P.S. except APO and P.O. Box which go parcel post. Foreign orders add $6.00/volume for air shipment and make payable in U.S. dollars only.

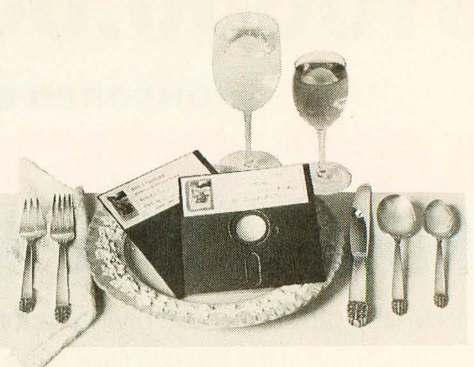
AVAILABLE AT MOST COMPUTER STORES
Master Charge and Bank Americard accepted.
Our Software is copyrighted and may not be reproduced or sold.

Unlike others we have NOT raised our prices in five years

No Purchase Necessary, to enter send name & address on a 3 x 5 card. You are automatically entered everytime you make a purchase from us.
Void where prohibited by law.

KEMCO, LTD.
P.O. Drawer 2208L Petersburg, VA 23803
24 Hour HOT LINE 800-528-6050 ext. 1184
In Arizona call 800-352-0458

No.12: Gourmet Goodies



Software for most popular 8080/Z80* computer disk systems including **NORTH STAR, iCOM, MICROPOLIS, DYNABYTE DB8/2 & DB8/4, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR MZ, MECA, 8" IBM, HEATH H17 & H89, HELIOS, IMSAI VDP42 & 44, REX, NYLAC, INTERTEC SUPER-BRAIN, VISTA V80 and V200, TRS-80* MODEL I and MODEL II, ALTOS, OHIO SCIENTIFIC, DIGI-LOG, KONTRON PS180, IMS 5000 DISKETTE** formats and **CSSN BACKUP** cartridge tapes.

Genuine CP/M for Apple II coming soon! Call for details.

Prices reflect distribution on 8" single density diskettes. If a format is requested which requires additional diskettes, a surcharge of $8. per additional diskette will be added. A surcharge of $25 will be added for software on CSSN format DC 300XL cartridges.

CP/M® VERSION 2 FOR TRS-80 MODEL II NOW AVAILABLE

All Lifeboat programs require CP/M, unless otherwise stated.

Software with Manual / Manual Alone

☐ **CP/M* FLOPPY DISK OPERATING SYSTEM** — Digital Research's operating system configured for many popular micro-computers and disk systems:

System	Version	Price
North Star Single Density	1.4	145/25 v
North Star Double Density	1.4	145/25
North Star Double/Quad	2.x	170/25
iCOM Micro-Disk 2411	1.4	145/25
iCOM 3712	1.4	170/25 v*
iCOM 3812	1.4	170/25 *
Mits 3202/Altair 8800	1.4	145/25
Heath H8 + H17	1.4	145/25 (M)
Heath H89	1.4	145/25 (M)
TRS-80 Model I	1.4	145/25 (M)
TRS-80 Model II	2.x	170/25
Processor Technology Helios II	1.4	145/25
Cromemco System 3	1.4	145/25
Intel MDS Single Density	1.4	145/25
Intel MDS Single Density	2.x	170/25
Intel MDS 800 Double Density	2.x	200/25
Intel MDS 230 Double Density	2.x	200/25
Micropolis Mod I	1.4	145/25 v
Micropolis Mod II	1.4	145/25 v

The following configurations are scheduled for release during the first half of 1980:

System	Version	Price
North Star Double/Quad + Corvus	2.x	250/25
North Star Horizon HD-1	2.x	250/25
Ohio Scientific C3	2.x	200/25
Ohio Scientific C3-B	2.x	250/25
Ohio Scientific C3-C	2.x	250/25
Micropolis Mod II	2.x	200/25
Mostek MDX STD Bus System	2.x	350/25 **
iCOM 3812	2.x	225/25 *
iCOM 4511/Pertec D3000	2.x	375/25 * +
TRS-80 Model II + Corvus	2.x	250/25

*Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * and ** include firmware on 2708 and 2716. Systems marked + include 5440 media charge. Systems marked (M) require the special (M) versions of software in this catalog. Systems marked v have minor variants available to suit console interface of system. Call or write for full list of options.*

☐ **MP/M*** — Intel MDS single density only (Documentation includes CP/M 2.0 manuals) .... **$300/$50**

☐ **Z80 DEVELOPMENT PACKAGE** — Consists of: (1) disk (M) file line editor, with global inter and intra-line facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file .... **$95/$20**

☐ **ZDT** — Z80 Monitor Debugger to break and examine (M) registers with standard Zilog/Mostek mnemonic disassembly displays. $35 when ordered with Z80 Development Package .... **$50/$10**

☐ **XASM-68** — Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to Intel hex .... **$200/$25**

☐ **XASM-65** — As XASM-68 for MOS Technology MCS-6500 series mnemonics .... **$200/$25**

☐ **DISTEL** — Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files, Intel or TDL/Xitan pseudo ops optional. Runs on 8080 .... **$65/$10**

☐ **DISILOG** — As DISTEL to Zilog/Mostek mnemonic (M) files. Runs on Z80 only .... **$65/$10**

☐ **SMAL/80** Structured Macro Assembler Language — (X) Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs .... **$75/$15**

☐ **tiny C** — Interactive interpretive system for teaching (X) structured programming techniques. Manual includes full source listings .... **$105/$40**

New Features → ☐ **BDS C COMPILER** — Supports most features of language, (M) (I) including Structures, Arrays, Pointers, recursive function evaluation, overlays. Includes linking loader, library manager, and library containing general purpose, file I/O, and floating point functions. Lacks initializers, statics, floats and longs. Documentation includes "The C PROGRAMMING LANGUAGE" by Kernighan and Ritchie .... **$125/$20**

☐ **WHITESMITHS C COMPILER** — The ultimate in sys- (L) (X) tems software tools. Produces faster code than a pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M .... **$630/$30**

Everything on #12 runs on 64K TRS-80 Model II

MICROSOFT

☐ **BASIC-80** — Disk Extended BASIC, ANSI compatible (L)(X) (M)(X) with long variable names, WHILE/WEND, chaining, variable length file records .... **$325/$25**

☐ **BASIC COMPILER** — Language compatible with (L) (M) BASIC-80 and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes MACRO-80. Also linkable to FORTRAN-80 or COBOL-80 code modules .... **$350/$25**

☐ **FORTRAN-80** — ANSI 66 (except for COMPLEX) plus (L) (M) many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) .... **$425/$25**

☐ **COBOL-80** — Level 1 ANSI '74 standard COBOL plus (L) (M) most of Level 2. Full sequential, relative, and indexed file support with variable file names. STRING, UNSTRING, COMPUTE, VARYING/UNTIL, EXTEND, CALL, COPY, SEARCH, 3-dimensional arrays, compound and abbreviated conditions, nested IF. Powerful interactive screen-handling extensions. Includes compatible assembler, linking loader, and relocatable library manager as described under MACRO-80 .... **$700/$25**

☐ **MACRO-80** — 8080/Z80 Macro Assembler. Intel and (L) (M) Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included .... **$149/$15**

☐ **XMACRO-86** — 8086 cross assembler. All Macro and (L) utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available .... **$275/$25**

☐ **EDIT-80** — Very fast random access text editor for text (L) with or without line numbers. Global and intra-line commands supported. File compare utility included. .... **$89/$15**

Price Slashed → ☐ **PASCAL/M*** — Compiler generates P code from ex- (I) tended language, implementation of standard PASCAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Untyped files allow memory image I/O. Requires 56K CP/M .... **$150/$20**

☐ **PASCAL/Z** — Z80 native code PASCAL compiler. Pro- (I) duces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, Microsoft Compatible relocating assembler and linker, and source for all library modules. Variant records, strings and direct I/O are supported. Requires 56K CP/M and Z80 CPU. .... **$395/$25**

New Version New Features → ☐ **PASCAL/MT** — Subset of standard PASCAL. Gener- (M) (X) ates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures, CP/M file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Version 3 includes Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the runtime package requires Digital Research's MAC. Requires 32K .... **$250/$30**

☐ **ALGOL-60** — Powerful block-structured language compiler featuring economical run-time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. Requires Z80 CPU .... **$199/$20**

☐ **CBASIC-2** Disk Extended BASIC — Non-interactive (M) BASIC with pseudo-code compiler and run-time interpreter. Supports full file control, chaining, integer and extended precision variables, etc. ..... **$120/$15**

MICRO FOCUS

☐ **STANDARD CIS COBOL** — ANSI '74 COBOL stand- (L) ard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full *ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal .... **$850/$50**

☐ **FORMS 2** — CRT screen editor. Output is COBOL data (L) descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by CIS COBOL (standard) .... **$200/$20**

Tasty lower prices!

EIDOS SYSTEMS

☐ **KISS** — Keyed Index Sequential Search. Offers com- (L) plete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. .... **$335/$23**

☐ **KBASIC** — Microsoft Disk Extended BASIC with all (L) KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS. REL as described above, and a sample mail list program .... **$585/$45**
To licensed users of Microsoft BASIC-80 (MBASIC) .... **$435/$45**

☐ **XYBASIC** Interactive Process Control BASIC — Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions.
Integer Disk or Integer ROMable .... **$295/$25**
Extended Disk or Extended ROMable ..... **$395/$25**

☐ **BASIC UTILITY DISK** — Consists of: (1) CRUNCH-14 (M) — Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC and TRS-80 BASIC. (2) DPFUN — Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic arc sin, etc. Furnished in source on diskette and documentation ... **$50/$35**

☐ **STRING/80** — Character string handling plus routines (M) for direct CP/M BDOS calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters, and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format. .... **$95/$20**

STRING/80 source code available separately **$295/n.a.**

☐ **THE STRING BIT** — FORTRAN character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source .... **$65/$15**

NEW → ☐ **VSORT** — Versatile sort/merge system for fixed length (M) records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine, VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported. .... **$175/$20**

☐ **CPM/374X** — Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data set contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files .... **$195/$10**

☐ **BSTAM** — Utility to link one computer to another also (M) equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. We use it! It's great! Full wildcard expansion to send ★.COM, etc. 9600 baud with wire. 300 baud with phone connection. **Both** ends need one. Standard and (M) versions can talk to one another. .... **$150/$5**

☐ **WHATSIT?*** Interactive data-base system using associative tags to retrieve information by subject. Hashing and random access used for fast response. Requires CBASIC-2 .... **$175/$25**

Lower Price! → ☐ **SELECTOR III-C2** — Data Base Processor to create (M) † and maintain multi Key data bases. Prints formatted sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source ... **$295/$20**

☐ **GLECTOR** — General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system .... **$250/$25**

NEW → ☐ **CBS** — Configurable Business System is a compre- (M) hensive set of programs for defining custom data files and application systems without using programming language such as BASIC, FORTRAN, etc. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval **with transaction processing.** Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. **No support language required** .... **$295/$25**

Prices and specifications subject to change without notice.

MICRO DATA BASE SYSTEMS

☐ **HDBS** — Hierarchical Data Base System. CODASYL oriented with FILEs, SETs, RECORDs and ITEMs which are all user defined. ADD, DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. SET ordering is sorted, FIFO, LIFO, next or prior. One to many set relationship supported. Read/Write protection at the FILE level. Supports FILEs which extend over multiple floppy or hard disk devices.

☐ **MDBS** — Micro Data Base System. Full network data base with all features of HDBS plus multi-level Read/Write protection for FILE, SET, RECORD and ITEM. Explicit representation of one to one, one to many, many to many, and many to one SET relationships. Supports multiple owner and multiple record types within SETs. HDBS files are fully compatible.

☐ **MDBS-DRS** — MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMs, RECORDs, or SETs are needed without changing existing data.

HDBS-Z80 version .... **$250/$40**
MDBS-Z80 version .... **$750/$40**
MDBS-DRS-Z80 version .... **$850/$50**
8080 Version available at $75. extra.

When ordering, specify one of the languages listed below.

NOTE → HDBS and MDBS manuals purchased alone come without specific language interface manuals. Manuals are available for the following Microsoft languages: 1) MBASIC 4.51, 2) BASIC-80, 5.0, 3) Compiled BASIC-80 or FORTRAN-80, 4) COBOL-80, 5) MACRO-80 .... **$NA/$10**

all Micropro prices are discounted!

MICROPRO

☐ **SUPER-SORT I** — Sort, merge, extract utility as abso- (L) lute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating & fixed point, exponential, field justified, etc. Even variable number of fields per record! . **$225/$25**

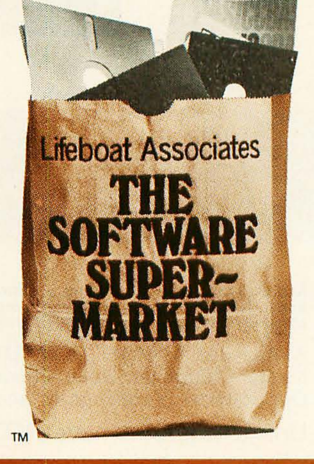
☐ **SUPER-SORT II** — Above available as absolute pro- (L) gram only .... **$175/$25**

☐ **SUPER-SORT III** — As II without SELECT/EXCLUDE (L) .... **$125/$25**

☐ **WORD-STAR** — Menu driven visual word processing (L) system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning .... **$445/$40**

☐ **WORD-STAR Customization Notes** — For sophisticated users who do not have one of the many standard terminal or printer configurations in the distribution version of WORD-STAR .... **NA/$95**

☐ **WORD-MASTER** Text Editor — In one mode has super- (L) set of CP/M's ED commands including global searching and replacing, forwards and backwards in file in video mode, provides full screen editor for users with serial addressable-cursor terminal .... **$125/$25**



Lifeboat Associates, 2248 Broadway, N.Y., N.Y. 10024 **(212) 580-0082** Telex: 220501 TM

7. Push SET, PAT, and 3.
8. Push SIXTEENTH four times.
9. Push END.

Note that there are now four sequences that can be defined. They are labelled on the score. I will create the commands for the first one only, since the others are similar:

1. Push SET, SEQ, and 1.
2. Push 3,1,2,1,2,1,1,1 on the PAT row.
3. Push END.

The other sequences consist of:

#2 - 3,1,3,1,1,2,2,1
#3 - 3,1,3,1
#4 - 2,2,2,2,2,1,1,1

The different ways of ordering sequences and patterns are numerous. The above score in particular could have been entered in several ways.

Using a scheme like this, any score of music can be entered into the editor. Other schemes could be devised to tailor the input form to the type of music being edited. The only changes to the program, however, would occur in the input-interface program; the main part of the editor would remain unchanged.

Symbols That Cross Over Measures

I have not yet approached the problem of symbols that cross over measures and, thus, over lines and pages. Nor have I discussed the placement of nested slurs or ties and how to draw them on the screen. These problems are complex; their solutions lie in keeping pointers in the character array to the locations where the symbol begins and ends. Any changes to these measures, such as deletion, must also change these pointers — for example, we do not have a beginning of a crescendo with no end. Thus these pointers must again be doubly-linked. Drawing the correct arcs for slurs and ties presents a problem because they can be separated by long distances. A routine must be called when the screen locations are known to fit a curve through these points.

Reformatting

After editing a page, the format of the pages from then on is usually different. If you simply added a

character in a measure, the paging will probably remain the same; however, if you add thirty notes to the measure, it is much longer, and might change the number of measures on the line and hence the format of the page. How far this change will carry depends upon the size of the change and the scaling factors of the measures. (If the scaling factors were all 1.0, then any change to a measure would cause a complete repaging of the score.)

Whenever the user wants to display or edit the score, a formatting program must be called to repage the score. This routine must execute the algorithms given previously, which determine the beaming groups of the measures and the measure lengths of all changed measures. It must then determine which measures will go on the lines. It needs to alter the existing paging only as far as the change propagates, but there is no way to predict this in advance. Thus a simple change could cause considerable computation.

Conclusion

I hope that the reader has begun to appreciate the problems involved in creating a text editor for music. What is the utility of such a program? To anyone who has ever tried printing a score of music with india ink, the virtues of an editor with hard-copy facilities are obvious. A number of uses for the program present themselves. For example, very often music written in one key needs to be changed into one of the other keys. This is called *transposition*. A program can easily be written which takes the contents of the character array and performs the transformation.

You might wish to create computer music and display it on the screen. You could write a music-generation program and feed its output to a conversion routine that would convert its output into the format of the editor. If actual sounds were converted into pitches and durations with an electronic device, this could be placed in the editor, and you could see the music that was being played. If several scores by a composer are entered into the program and statistical analysis is performed on them to determine the probabilities of certain patterns of music, the results could, in theory, be used to drive a music-generation program that would simulate the composer's style. This same approach could be applied to music from different historical periods, thus enabling the computer to create a classical symphony or a twelve-tone quartet.■

Editor's note: The data-entry system for musical scores described in this article has a bias toward transcription of scores containing a single melodic line. Other types of musical scores contain elements which are not dealt with here. For instance, music for keyboard instruments, such as the piano, usually contain chords consisting of several notes to be sounded simultaneously. These chords are often written as several note heads sharing a single stem. It would be difficult at best to work with such music using this system. Enhancing the system to handle these elements would be a good project for the ambitious reader. . . . **RSS**

The FLEX™ Disk Operating System

FLEX™ is a powerful, easy-to-use disk operating system which has become the standard for 6800 and 6809 microprocessor systems. Two new versions are now available and both include a disk editor and assembler:

FLEX for the EXORciser™ $150.00

Runs on a Motorola EXORciser with EXORdisk™ II or III. Requires no hardware modifications with the possible exception of memory re-addressing. Uses the same boot as MDOS™.

FLEX for General Use $150.00

Fully documented to allow a user to write his own terminal and disk I/O routines to adapt to most any hardware. Three system requirements are: (1) at least 12K of RAM at $0000; (2) 8K of RAM at $A000 for 6800 or $C000 for 6809; (3) floppy disk drive capable of 256-byte, soft sectors. This package is not for beginners!

FLEX Support Software

Extended BASIC	$100.00
Standard BASIC	65.00
New! 6809 Diagnostics Package	75.00
Text Processing System	60.00
Sort/Merge	75.00
68000 Cross Assembler	250.00
6809 Cross Assembler	100.00
6809 FLEX Utilities	60.00
6800 FLEX Utilities	100.00
6809 Debug Package	75.00
6800 Debug Package	55.00
FLEX for SWTPc	90.00

Be sure to specify disk size and 6800 or 6809. All orders should include 3% postage and handling (10% on foreign orders). Mastercharge and Visa are welcomed.

FLEX is a trademark of Technical Systems Consultants, Inc.
EXORciser, EXORdisk, and MDOS are trademarks of Motorola, Inc.



Box 2570, West Lafayette, IN 47906
(317) 463-2502

6809 6809 6809 6809 6809 6809 6809 6809 6809 6809 6809 6809

Circle 69 on inquiry card.

Using the Computer as a Musician's Amanuensis

Part 2: Going from Keyboard to Printed Score

Jef Raskin
Apple Computer Co
10260 Bandley Dr
Cupertino CA 95014

More Problems with Rhythm and Tempo

The would-be Composer's Aid designer plummets into another pile of programming problems when tempi change. The beat, *sometimes* constant within a piece, may abruptly slow down, as may happen in a reflective refrain in a blues number, or gradually accelerate, as in a Greek folk dance. Changes of tempo present problems that are worse than the problems in transcribing rhythms that we have already seen.

It is not difficult to see that an abrupt change in tempo cannot be detected the instant that it happens, but only after a few notes have been played at the new speed, establishing, as musicians say, the new tempo. This brings up the concept that rhythm does not exist only in relation to the length of individual notes, but exists also in a much larger musical context.

Therefore, a computer (or a human being) cannot notate rhythm in real time (ie: as it happens). The notator must wait and accumulate a significant sample (ie: listen for a while) before making any decision how to write down what has been heard. A computer program that must determine rhythms will most probably have to backtrack through the data, perhaps a number of times, before deciding how to notate the music.

A computer (or a human being) cannot notate rhythm in real time.

Much of the fun in listening to music comes from anticipation of the rhythm; the composer or performer can use rhythmic expectations as a background against which to introduce rhythmic novelties. This is similar to the use of harmonic and melodic "surprises" that cannot be assessed until some time after they have been heard. The fact that we hear music in a context of expectations built on previous experience stands as a sentinel, guarding against the possibility that there is an easy algorithm that might "understand" music on a note-by-note basis.

Further Consequences of Changes of Tempo

A gradual change of tempo is either *accelerando* (getting faster) or *ritardando* (getting slower). In ritardando (very common at the ends of pieces or sections of pieces), how is the computer to tell the difference between a gradual lengthening of the written note values on one hand, and the use of the word "ritardando" along with an actual constant note length, on the other? This is very easy for a human to do, but it is very difficult to tell a computer how we do it.

In many pieces that require this slowing down, there is no notation for a ritardando at all. In these cases, the ritardando is inherent in the nature of the music. The conventional notation is to write the score as if nothing at all happens to the tempo.

This last problem afflicts score-to-performance transforming programs more than it afflicts programs that transform performances to scores. It is one of the symptoms of "soulless" computer performances. The computer too often is programmed with only the notes, but not with the *style*—that part of the music which is indigenous to a culture or time. Without the proper style, music tends to sound "wooden" or "dead."

About the Author

Jef Raskin's credentials in music include his years as a professional musician and a music teacher. He is presently the manager of Advanced Systems at Apple Computer Co. His personal music and computer equipment includes a piano, a harpsichord, an organ, a PDP-11, and three Apple II computers.

Someone Tries to Sell the Author a "Notating Machine"

An entrepreneur tried to interest me in funding a device he was in the process of patenting. According to him, it would do the "simple" task of transcribing any rhythm tapped out on its surface into standard musical notation. It was to be the size of a hand-held calculator.

I asked him the questions that I have brought up in this discussion, and it soon became clear that he had not given the matter even as much thought as I have been giving the problem in this article. As an answer to the question of accelerando and ritardando, he suggested that the instructions would specify that the user must not slow down or speed up.

As happens too often in the world of computing, he was forced to lean toward a device that would—perhaps—write down the easy rhythms, leaving the difficult ones for the user to figure out. Most users, I suspect, would rather have a device to write down the difficult rhythms. The users can figure out the easy ones without mechanical aid.

Incidentally, one of the most difficult problems for a beginner to solve is determining on which beat of a measure a piece begins. Pieces very often begin in the middle of a measure. This is also a vexing problem for anyone who would program a computer to notate rhythms.

Placing any restrictions not found in the music itself on the user seems inherently wrong to me. The system must accommodate the person, not the other way around.

There are many other problems with rhythm—for example, *rubato*, where one part momentarily goes faster or slower than accompanying parts. Another class of problems are rhythmic complexities such as triplets, grace notes (so short that their time value is not notated), and other groups of notes that break the simpler rhythmic patterns.

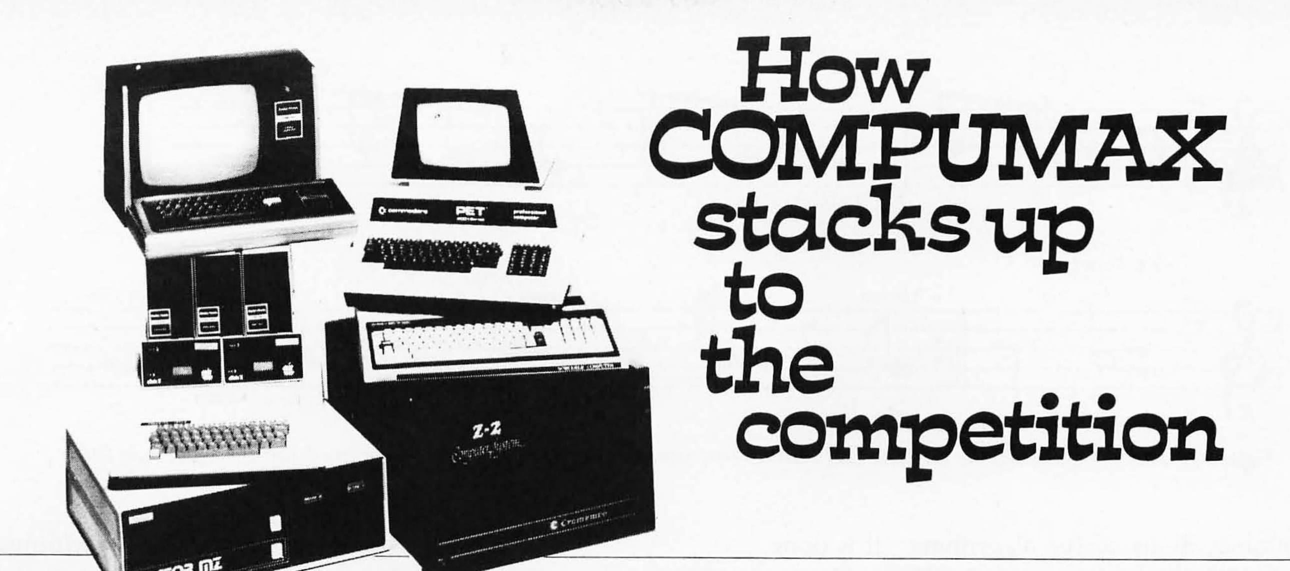
A *triplet* is a melodic phrase consisting of three notes of equal length, three quarter notes, for instance. These three quarter notes are played in the same time interval that two quarter notes occupy in the normal rhythm of the piece. It is difficult to tell what has happened when a few triplets are introduced in a piece. When they first occur in a piece, you may ask yourself (if you are a trained musician), "Has the tempo suddenly changed, or have triplets been introduced?" The program will be hard put to guess at the difference.

Another problem occurs when very long notes occur in a piece which previously consisted only of relatively short notes. You must decide, for instance, whether to write them as tied shorter notes or as longer note forms. Of course, they might be written as the *same* note-length notations as the earlier, shorter notes, but with a tempo change!

All of this judgment of tempo must be done in the face of the first problem, that the note lengths and inception times are not coming in precisely, but with considerable variation. Often, the amount of this variation may mask tempo or rhythmic changes. Consider, too, that the people who need the Composer's Aid most are those who may be least proficient at performing upon conventional instruments. The designer probably has a more difficult task to make the Composer's Aid accurately portray the muddled attempts at rhythmic regularity of a beginner, than to make it follow the (probably) more precise playing of a master.

Before leaving the subject of rhythm, I shall take the liberty to give the following advice to all would-be designers of automatic music-transcribing systems. First, build one that has but one key or button, and get it to determine rhythms correctly. By "correctly " I mean without unreasonable limitations. It should be able to handle any rhythm found in a Mozart or a Beatles' melodic line. If you cannot master that, then you certainly cannot transcribe more complex music, which might have a solo melody as a part of a piece.

The problems of rhythm are not



How COMPUMAX stacks up to the competition

COMPARISON SHOPPING? STOP HERE!

IMPORTANT QUESTIONS ABOUT BUSINESS SOFTWARE	COMPUMAX	OSBORNE/ McGRAW HILL	PEACHTREE SOFTWARE	STRUCTURED SYSTEMS
What programs are available? *Are they INTERACTIVE?*	*INTERACTIVE:* GENERAL LEDGER, ACC'TS PAYABLE, ACC'TS REC'BLE, INVENTORY, PAYROLL/PERSONNEL	*INTERACTIVE:* GENERAL LEDGER, ACC'TS PAYABLE, ACC'TS REC'BLE, PAYROLL	*INTERACTIVE:* GENERAL LEDGER, ACC'TS PAYABLE, ACC'TS REC'BLE, PAYROLL *NON-INTERACTIVE:* INVENTORY	*INTERACTIVE:* GENERAL LEDGER, ACC'TS PAYABLE, ACC'TS REC'BLE *NON-INTERACTIVE:* STOCK CONTROL, INVENTORY
What versions are available?	TRS-80, APPLE II, COMMODORE PET, MICROSOFT, CBASIC2 CP/M$_R$, MICROPOLIS: EXIDY SORCERER, VECTOR MZ, DYNABYTE, CROMEMCO III	WANG CBASIC2 CP/M$_R$	MICROSOFT CP/M$_R$	CBASIC2 CP/M$_R$
What is the price?	MICROLEDGER, A/P, A/R, INV, PERS: $140.-each. MAXILEDGER, ORDER ENTRY $350.-each.	One-time dealer cost: $250 each. Suggested book price: $20 each, without machine-readable code.	GL, A/P, A/R, PAYROLL, INVENTORY $1000 each.	GL $995.- A/P $750.- A/R $750.- INV. $500.-
Hardware options	40 column CRT, 64 column CRT, 80 col. terminal, 80 col. printer included	64 col. CRT or terminal minimum. 132 col. printer.	80 col. CRT only, 132 column printer only	cursor addressable terminal only, 132 column printer only.
Is source code included?	YES, INCLUDING PROGRAM FLOWCHARTS.	YES	YES	NO
What type of after-purchase support is offered?	1 YR WARRANTY & CORRECTION OF DEFECTS THROUGH DEALER. INDIVIDUAL PROGRAM AUTHORS AVAILABLE FOR QUESTIONS.	DEALER IS RESPONSIBLE FOR SUPPORT.	1 YR WARRANTY & CORRECTION OF DEFECTS THROUGH DEALER.	TECHNICIANS AVAILABLE FOR QUESTIONS. UPDATES MADE AVAILABLE FOR A FEE.

Prices and specifications available Feb. 1980. CP/M is the registered trademark of Digital Research.

COMPUMAX is your one-stop shop for all your business bookkeeping software.

You've been led down the path before, but not this time. No more promises of turnkey computers without the key. It's YOUR turn to tell the computer how to run the business, not vice versa.

With COMPUMAX software you have a beginning. With 5 years of experience and over 3,000 systems installed, they are professionals, when it comes to solutions for the businessman.

COMPUMAX software is designed with CHANGE in mind, since everybody really wants his own touch added. The programs are SIMPLE, YET ELOQUENT.

COMPUMAX supplies ready, working programs. You can, then, easily customize them, as your additional requirements develop.

Or do as many have done—keep it simple by running the programs in their ready form. Join the microcomputer revolution the simple way.

For a demo, visit your local computer store. If you local retailer does not carry COMPUMAX software, have him give us a call at (415) 321-2881.

COMPUMAX

467 HAMILTON AVENUE PALO ALTO, CA 94301

Circle 72 on inquiry card.
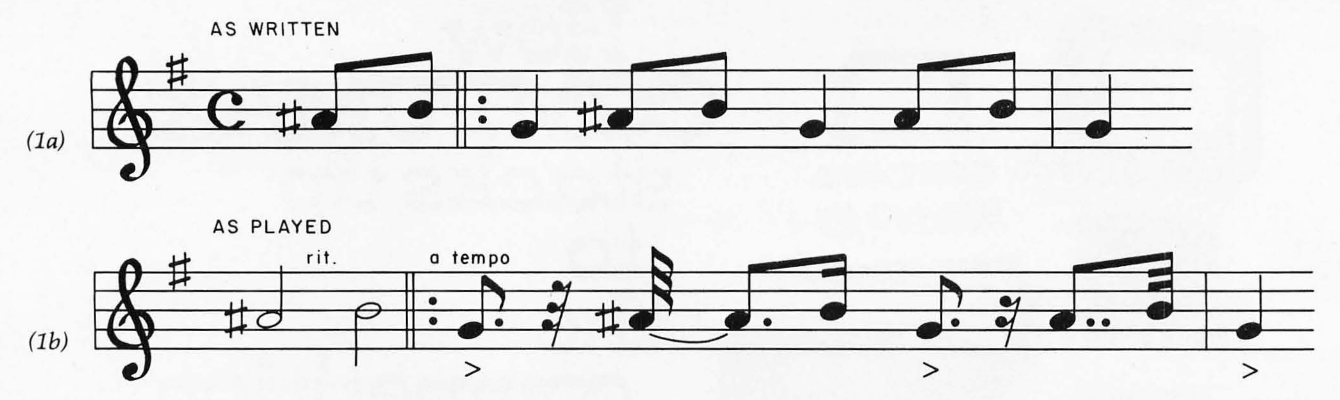


Figure 1: *The same passage as written (1a) and as performed (1b). Both examples here are from the "St Louis Blues."*

unexplored. Some of the algorithms that adaptively follow varying-rate Morse code may be useful. A number of moderately successful programs, all quite large and complex (using many techniques from artificial intelligence work, and *not* operating in real time), have been created. [*The October 1976 issue of BYTE contained several discussions of Morse-code decoding problems. . . .***RSS**]

If you first succeed with rhythm, *then* you might have a chance at the rest of the problem. At least a good portion of the problem of transcribing a musical performance into a standard score will have been solved.

More and Less

It is clear that a performance of a piece often contains *more* information than is given in the score: things happen in the performance that are not specified in the written music. Jazz, usually played from sketchy "charts," is an especially good example. The lilting "dotted" rhythms of jazz are notated as equal notes on the page. But everyone "knows" how it should sound. Look at the example from W C Handy's "St Louis Blues" in figure 1.

It is clear that the performance in figure 1b is quite different from the written notation in figure 1a, as it must be in order to sound right. The figure shows just one possible way of singing the opening measure of the chorus to the "St Louis Blues" (and it is not an especially extreme example).

It is rare, if not unheard of, that two live performances are the same. Some of the changes are minor, such as changing two eighths to a dotted eighth and a sixteenth. More surprising is the modification of the opening two eighth notes into half notes (with a ritard, no less). But that is the way it is done.

Strangely enough, the same convention about playing eighth notes with a certain uneven lilt occurs in much baroque music, in spite of the fact that the notes were written down as being of equal length. Many performances of Bach's music, for example, are marred by a "wooden" playing of such passages.

Many conductors and performers play baroque music exactly as it is notated. It sounds as if you tried playing jazz or rock exactly as written in songbooks and sheet music: the result is dull music. This may help to account for some of the comments about baroque music sounding like a melodic sewing machine—some performers play it as though their in-

INPUTS → / OUTPUTS ↓	Musical Idea	Score	Keypresses	Sound
Musical Idea	Inspiration	Plagiarization	Stimulation	Synthesized Music
Score	Composition	Arranging, Copying	Transcription	Taking Dictation
Keypresses	Improvisation	Performance	Coupling	Playing By Ear
Perceived Sound	"Science Fiction"	Automation	"Sonification"	Transmission

Table 1: *Musical transformations, representing the various ways of obtaining musical results. The table is read by starting at the top at a given input and proceeding downward and to the right to read the output. The shaded example illustrates that the term* performance *describes the connection between a printed score and the production of keypresses. (For simplicity's sake, the table deals only with keyboard instruments.) Similarly, to go from a musical idea (ie: input) to a score (ie: output) requires "composition." The term* coupling *refers to the mechanical addition of extra voices to an organ keyboard so that the organist can play more than one pipe with a single keystroke.* Automation *refers to the procedure by which mechanical musical instruments (such as music boxes and player pianos) take a score in machine-readable form and generate perceived sound. For want of a better word,* sonification *is used to describe the production of perceived sound from pressing a key on a keyboard. The terms in the row called "musical idea" are meant to be taken tongue-in-cheek.*

No typing skills required

It's easier and more accurate to enter alphanumeric data with a BIT PAD than a keyboard. Now anyone can. . .

- Enter whole lines of characters with a single stroke.
- Enter data directly to business forms by simply checking a box.
- Enter variable alphanumeric data from a menu keyboard.

Take a printed form—price list, order entry, loan or insurance application, laboratory request—lay it on the BIT PAD tablet and touch the pertinent items with the pen. The information is entered directly into your data processing system.

Plus, the BIT PAD does even more.

Try to describe a fluctuating business trend to your computer through a keyboard. With BIT PAD you simply trace the trend with the pen. Special keyboard menus can be created by the user to enter high level languages, foreign languages or special symbols.

Before you order any kind of data entry equipment, ask Summagraphics to give you the full story on the BIT PAD ONE.

Summagraphics Corporation, 35 Brentwood Avenue, Fairfield, Connecticut 06430; or call Marketing Department, Peripheral Products (203) 384-1344.



See us at NCC booth 1345.

The BIT PAD™ alternative to keyboard data entry

struments *were* sewing machines, without any regard for the original stylistic intent.

Problems Caused by Repeats and Larger Musical Structures

Here is another dilemma: how can a computer (or a human) tell if a section of a piece being performed has been repeated (perhaps with embellishments), or if it is a new section merely similar to the old one?

For example, in a Mozart rondo for the piano, almost all of the embellishments will be written out in full. In a Mozart sonata for the piano, there will usually be repeats marked and any variety will be at the performer's option. Does this mean that the computer must first be told the form of the piece before it can transcribe it? Knowing the form of a piece beforehand certainly aids a human transcriber.

Again, there is vague and general information that must somehow find its way into the program. As in having the computer play chess, methods have been found for translating an imprecise notion (eg: control the center of the board) into algorithms. Chess is a rich field, rife with human invention and complexity. Music is a more complex environment.

Problems With Notating Pitch

Having shown that there is information in a performance that is not to be found in the score (this is always the case), I would like to show that often there is information in the score that cannot be gleaned from the performance. The "spelling" of chords is one example. The two chords in figure 2 sound exactly the same on our equal-tempered organ. Nevertheless, they would be thought of differently by a musician playing them.

The notes of the two chords actually represent different pitches if sung or played on violins (or any instrument which allows the performer to vary pitch continuously rather than in discrete steps, as with an organ or piano).

The three sets of melodic notes in figures 3a thru 3c sound the same, and are all correctly but differently notated. Again, a human might guess which is the correct notation by means of global information, the musical context in which the passage occurs. In this example, the global information is the key of the piece and the customary clef of the instrument that is to play the tune. Is it reasonable to have the user predetermine the key for the computer? Or should the computer wait, as a human often must do, until the very end of the piece has been played before beginning to write it down?

Problems Transcribing Notes Sounded Simultaneously

On keyboard instruments such as the organ or piano, the performer can easily sound more than one note at any given instant. These notes may form a chord, or can be thought of as two or more melodies that are being played at the same time. In this latter case, each melody is called a *voice*. (This use of the word "voice" in music does not imply singing.) Multiple,

Figure 2: *Example of the equivalence of two musical notations. The chords notated here are played the same way on a keyboard instrument and sound the same, but they are written in different ways. This difference, however small, subtly influences the way many musicians interpret the chord.*
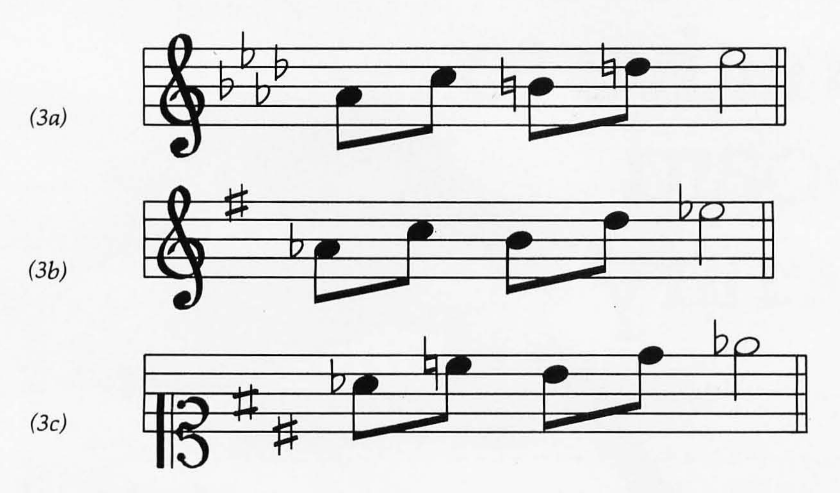


Figure 3: *Different notations for the same sounds. The three melodies here, when played, will sound exactly the same; the only difference is the choice of clef and accidentals. The first two melodies are written in the keys of A-flat Major and G Major in treble clef; the third melody is in the key of D Major in soprano clef.*
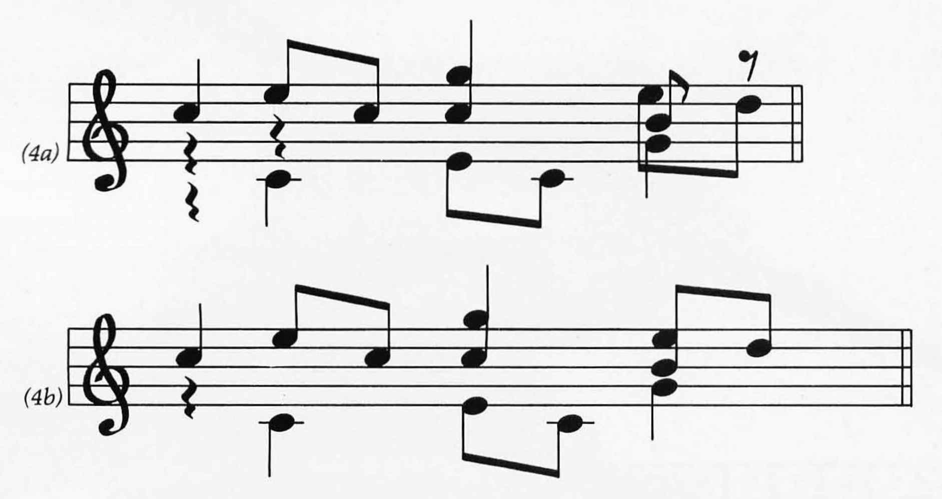


Figure 4: *A musical phrase played with two different voicings. These two phrases may sound the same, but the two correct, differing notations convey different meanings to a musician.*

simultaneous voices bring another host of difficulties to the attempt for accurate transcription.

It is nearly impossible for even an expert musician to determine unambiguously, from listening alone, which note should be allocated to which voice. I realize that this portion of the discussion is delving heavily into the terminology of music, but the intricate details of music are what make this problem so fascinating. The two segments of music in figures 4a and 4b sound the same, and are both notated correctly. Nevertheless, the differences are significant and useful to the musician performing the music.

This is not the place to go further into the musical significance of these notational differences. Enough examples of problems have been amassed to give you a starting place at which to begin to think about having a computer "listen" to and "understand" music.

Problems in Determining Pitch With a Computer

If things were not difficult enough given direct input from a keyboard, many people (eg: ethnomusicologists) would love to be able to play a recording into a computer and produce a written score. So would I. However, two new problems are introduced. Finding what pitch is being played is not easy. To be sure, a simple sine wave could be digitized by a frequency counter. Unfortunately, real musical sounds are far more complex, often having harmonics and overtones that make almost any frequency-determining method unsure. And what do you do when a note slides from one frequency to another (*portamento* in musical jargon)? Or when a chorus finishes singing a chorale a semitone lower then when they started—will the computer notate it as a sudden modulation in the middle?

Even determining how long a note lasts is difficult. Try playing a piano note; strike a key and hold it down. How long does it last? Just when does its gradual dying away cease? In a quiet room, with a good piano, it may take several minutes. You might as well ask where the rainbow changes colors. Musical sounds often do not have well-defined edges with respect to time or pitch.

Summary

The point has been made, and it is possible to show many more examples than have been shown here that you cannot go from a performance to a score, or vice versa, in any easy fashion while preserving the qualities that make the notation of music readable to most musicians and the properties of a performance that make it worthwhile listening material.

A score is a highly idiomatic rendering of a piece of music, and a piece of music is a unique instance of the composition that the composer had in mind when the score was written.

These facts assure that the building of a perfect music transcriber is literally impossible. Whether it is possible to make the Composer's Aid good enough for most practical purposes remains to be seen. If we put low enough limits on the idea of "good enough," I am sure that it can be done quite easily. If it is to satisfy me (and musicians of like mind), it will probably not be easy at all.

A final suggestion: if you want to tackle any project of this sort, make sure that you know music well. Also make sure that you know your computing well or forge a partnership that can provide the needed experience. I have met many people who do not know the first thing about music trying to achieve difficult goals combining computers and music. I have also met musicians who imagined that they could get the computer to do some task that they found very easy—only to discover that they did not understand the difficulty of what they themselves could easily do.

The greatest benefit the computer confers upon mankind is that it forces us to truly understand what we are doing, for it is only through such understanding that we can instruct a computer.■

Acknowledgments

I would like to thank the many people who have made useful suggestions about this article, and I would like to specially mention Doug Wyatt of the Xerox Palo Alto Research Center for many useful discussions about the nature of music, Brian Howard of Apple Computer Co for his excellent editing and criticisms, and both of them for the many hours of rehearsal, performance, and programming that they have shared with me.



Let this New Series from BYTE BOOKS™ answer your programming questions

Programming Techniques is a series of collected articles concerned with the art and science of computer programming. The first volume in the Programming Techniques series is entitled **Program Design.** The purpose of the book is to provide the personal computer user with the techniques needed to design efficient, effective, maintainable programs.
ISBN 0-07-037825-8 Pages: 96
Price: $6
Editor: Blaise W. Liffick

Simulation is the second volume in the Programming Techniques series. Both theoretical and practical applications are included. Particularly stressed is simulation of motion, including wave motion and flying objects, and the use of simulation for experimentation.
ISBN 0-07-037826-6 Pages: 126
Price: $6
Editor: Blaise W. Liffick

Numbers in Theory and Practice is the third book in the series. It includes information of value to both the novice and the experienced personal computer user. The mechanics of the binary system are discussed, including software division and multiplication, as well as floating point numbers, numerical methods, random numbers, and the mathematics of computer graphics.
ISBN 0-07-037827-4 Pages: 192
Price: $8.95
Editor: Blaise W. Liffick

The 4th volume of the Programming Techniques series, **Bits and Pieces,** covers various topics of interest to programmers. It is a collection of the best articles from past issues of BYTE magazine plus new material collected specifically for the series, on subjects such as multiprogramming, stacks, interrupts optimation, and real time processing.
ISBN 0-07-037828-2 Pages: 160
Price $8.95
Editor: Blaise W. Liffick

McGraw Hill

B5

Please send
☐ ______ copies of **Program Design**
☐ ______ copies of **Simulation**
☐ ______ copies of **Numbers in Theory and Practice**
☐ ______ copies of **Bits and Pieces**

Name Title Company

Street City State/Province Code

☐ **Check enclosed in the amount of $______**
☐ **Bill Visa** ☐ **Bill Master Charge**
Card No. ______ Exp. Date ______
Add 60¢ per book to cover postage and handling.

BYTE BOOKS

70 Main St, Peterborough, NH 03458

Circle 51 on inquiry card.

Comparing Floppy-Disk Drives by Software Simulation

Dennis Nendza
1622 W Ave de Maximillian
Tucson AZ 85704

Large companies learned long ago that preliminary performance specifications of systems can be predicted reasonably well by computer simulation. The National Aeronautics and Space Administration (NASA) saved much money and effort by simulating numerous systems that have been developed for the space program. In a somewhat smaller way, microcomputers can be used to simulate a variety of operational systems. Complex equations and analysis are not always required.

Here I shall present a practical simulation. I have chosen a topic of interest to myself and many small-computer enthusiasts: a comparison of the operating speeds of floppy-disk drives. This article will explain basic mechanical drive movements and illustrate the transformation of these physical events into the algorithmic steps of a computer program. Estimating one drive's performance in relation to others is the goal.

To do such a comparison, we need some knowledge of the operational parameters of floppy-disk drives. These parameters are the lengths of time required for a drive to perform a given function. All drives have at least these four parameters:

- head load
- seek
- rotational latency
- data-transfer rate

I shall look at each function in detail.

Head-Loading Motion

Before any data can be located or transferred on some drives, the data-transfer head must be *loaded*; firm contact between the head and the disk surface must be assured. To accomplish this, a pressure pad is placed against the disk on the side opposite the head. This pressure pad movement is referred to as *loading the head*. The length of time required to move the pad into place and insure that all mechanical bouncing has stopped is termed *head-load time*. Look at figure 1 to see a diagram of the head-load mechanism.

Track-Seeking Motion

Once the head is loaded, it may be necessary to move the head to a position over another data track on the disk. In most drives, the track-to-track movement, or *seeking*, is accomplished by a *stepper motor*. This motor rotates in steps of fixed, discrete increments; a specific interval of time is required for each incremental movement. Thus, to move the head across X tracks takes an amount of time equal to X intervals. Once we know the time interval required to perform a movement and the number of tracks to move across, we can predict how much time it will take the head to reach the desired track.

All stepper motors exhibit some vibration at the end of the last step in a given movement. There may be a settling time required before a read or write operation can begin.

Another type of motor is used in floppy-disk drives such as the PerSci Model 277. It is called a *linear motor* since it produces linear motion directly. The method is also called "voice-coil" positioning, due to the similarity to the action of a loudspeaker mechanism. Figure 2 depicts the stepper- and linear-motor positioning systems in simplified form.

The amount of time required per track for the linear motor to perform a seek operation varies according to the total number of tracks to be skipped. Unless the manufacturer supplies data describing the seek-time

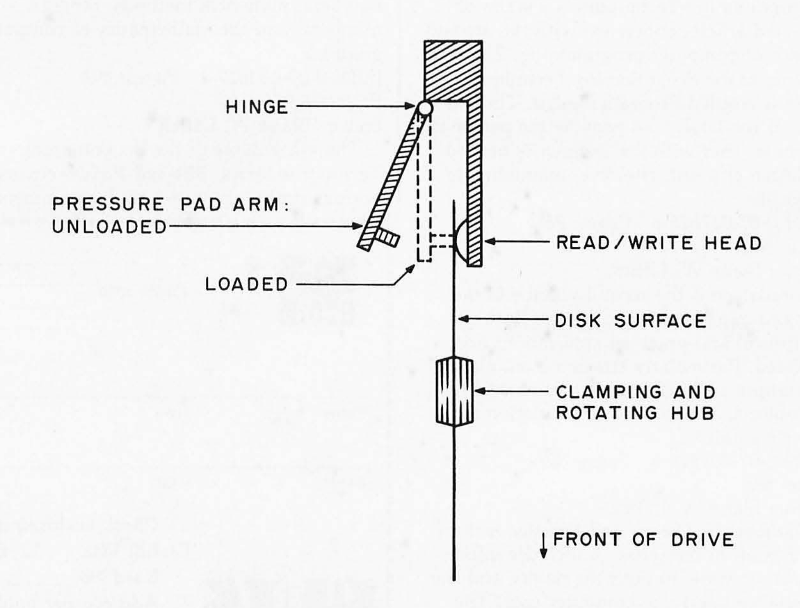


Figure 1: *Diagram showing a side view of the floppy disk loaded in the drive. When loaded, the read/write head is pressed against the surface of the disk by the pressure pad.*

About the Author

Dennis Nendza is 32 years old and is currently working as a computer systems consultant, after previous experience as a systems programmer, analyst, and data processing manager. He wrote his first computer program while in high school, using the ALGOL language.

YOU'RE A GENIUS FOR BUYING DATASTAR.™

But you don't have to be one to use it.

Now, from those wonderful folks that brought you WordStar,™ comes DataStar.™ A general purpose key to disc data entry software package you don't have to be a graduate from M.I.T. to operate.

DataStar makes life a breeze because DataStar makes data entry and verification a breeze.

It has two distinct phases. One allows you to actually design on the CRT the exact form you need. Just name the job. If it can be done on a CP/M* based microcomputer, then DataStar can do it. From handling inventory and billing to entering names in the office football pool. How's *that* for flexibility!

The other phase allows you to store and retrieve data. All kinds of data. Quickly and accurately. Which also allows you a chance for that second coffee break, you genius you.

And don't worry, DataStar makes sure that what you put into the system is right; because even a genius like you can sometimes make a mistake.

So go ahead. Let DataStar bring out the genius in you.

Simply call us at (415) 457-8990. After all, with over 300 dealers around the world, we've made *buying* DataStar as easy as *using* DataStar.



The world leader in microcomputer word processing.

MicroPro International Corporation 1299 4th Street, San Rafael, California 94901 Telex 340388
Dealer/Distributor/O. E. M. inquiries invited.

*Trademark of Digital Research Corporation

Prices and specifications subject to change without notice.

"Stop by booth 16 at the NCC & Personal Computing Festival in Anaheim so we can brag, brag, brag."

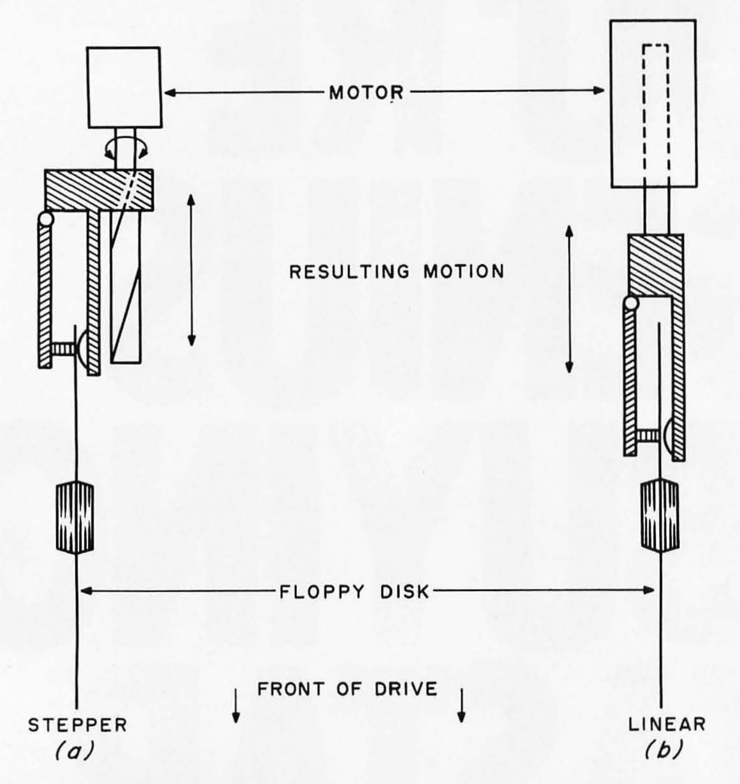


Figure 2: *Two methods of moving the read/write head from track to track across the disk. A stepper motor is shown as (a); a linear or "voice-coil" motor is shown as (b). The rotary motion of the stepper motor must be converted into linear motion by a gear arrangement.*

function, it must be derived from empirical measurements. This derivation, however, is not within the scope of this article.

Rotational Latency

Reading and writing operations are equivalent functions with respect to the actual time required for completion. With that in mind, the discussion will proceed as if a read operation is being executed. Assuming that the head is now loaded and positioned over the proper track, it remains for us to examine how long a delay may be expected in waiting for the desired record to spin past the head.

A look at figure 3 shows how most soft-sectored disk formats appear. Actually, the soft-sectored format contains 128 bytes of user data; the other data locations are used as address marks and gaps between certain fields. To determine the extent of the delay that must be endured before the desired sector is available, I will consider two cases.

The first case occurs when we begin a read operation and find the correct sector just about to pass by the head. In this event, there is no wait or *latency*, as it is called, before starting the transfer of data. The second case shows that the beginning of the desired sector just went by an instant before the read operation was started. We must now wait for one full rotation of the disk, or the *maximum rotational latency*, for the record to appear at the head again. These two extreme cases show that there are well-defined minimum and maximum rotational latencies. Of course, most delays will be at some random point within this range for actual read operations. The absolute delay for a single read operation is not predictable, but the average for a group of read operations is predictable within limits.

Data-Transfer Time

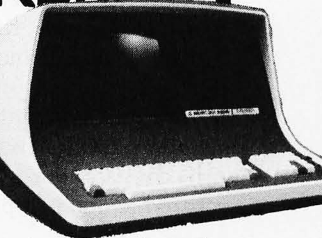
Finally, there is the most obvious function of the disk drive, data transfer. Data-transfer time is dependent on three basic parameters: disk rotational speed, data density, and format. The faster the disk surface spins past the head, the faster the

The

COMPUTER FACTORY

TO ORDER CALL (212) 687-5000

SUPERBRAIN™



INTERTEC DATA SYSTEMS

64K ONLY **$2995**

32K $2795

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing. . .the SuperBrain handles all of them with ease.

FEATURES INCLUDE:

- 2 dual-density minifloppies with 285K bytes of disk storage
- 64K of RAM to handle even the most sophisticated programs
- a CP/M Disk Operating System with a high-powered text editor, assembler and debugger.

NEW Model QD $3895
With Dual Density/Double Sided Drives with 720K bytes disk storage and 64K RAM

apple BREAKTHROUGH!

New KRAM 2.0 Software for Apple ONLY $99.95

Keyed Random Access Method - The new, ultra-fast access method for Apple or Corvus disks, provides keyed retrieval/storage of data, in either direct or sequential mode, by either full or partial key values. Written in 6502 machine code allowing full optimization of your system. Eliminates the need for "Sort" routines! KRAM 2.0 is modeled after a very powerful access method used on large-scale IBM virtual storage mainframes.

KRAM 2.0 Functions:
- Create/Open Dataset
- Get record by Full or Partial Key
- Add or delete record by Key
- Put record by Key
- Read next or previous record
- Dynamic space reclamation
- Requires 32K or 48K Integer Apple or Integer Card

NEW

Commodore Computer

These low cost Commodore PET **Business Computers** have virtually unlimited business capabilities. Accounts Receivable, Inventory Records, Payroll, and other accounting functions

PET 16N & 32N COMPUTERS
- Full size keyboard
- 16 or 32,000 Bytes Memory
- Level III Operating System
- Full Screen Editor
- Upper lower case & 64 graphic characters

$995



PET DUAL FLOPPY DISK
- Stores 360,000 Bytes on-line
- Microprocessor controlled
- Uses single or dual sided floppies

$1295

HI-SPEED PRINTER
- 150 characters per second
- Up to 4 copies 8" wide
- Microprocessor Controlled
- Prints All Graphics
- Full Formatting Capability

$695

PERIPHERALS FOR PET

24K Memory Expansion	$499
16K Memory Expansion	399
PET to RS232 Serial	179
2 Way Serial/Communication	229
Modem Board for PET	375
Analog to Digital Board for 16 Devices	275
Second Cassette Drive	95

apple



11 Megabyte Hard Disk For Apple $ 4995

APPLE II PLUS ONLY **$1195**

A complete self-contained computer system with APPLESOFT floating point BASIC in ROM, full ASCII keyboard in a light weight molded carrying case.

Features Include:

- auto-start ROM • Hi-Res graphics and 15 color video output.
- Expandable to 48K.

Supertalker	$279	Micromodem	$379
Disk	595	Superterm (24 x 80)	395
Add-on Disk	495	Speechlab	229
Pascal Card	495	Communication Card	225
Business Software	625	Modem	200
Monitor	159	Graphics Printer	595
Printer Card	180	Graphics Tablet	795

CENTRONICS 704



- 180 cps Bi-Directional • Up to 15" Paper Width • 9 x 9 Matrix
- Upper/Lower Case
- Tractor Feed
- RS-232 Serial Interface

$1895 List $2500

CENTRONICS 700-9

$1295 List $1895

- 60 cps • Up to 15" paper width
- Tractor Feed • Parallel Interface for Apple & TRS-80 • 2 channel vertical forms! • Top of Form!

CENTRONICS (Letter quality)

737 Serial $995
737 PARALLEL $965

CENTRIONICS

730 Serial $845
730 Parallel $795

Great PET Software

DATABASE MANAGEMENT SYSTEM — Six modules comprising 48K of programming allows you to: create, edit, delete, display, print, sort, merge, etc., etc. — databases of up to 10,000 records. Printer routines included. 60 Pages of documentation for 16-32K PET and 2040 Dual Disk... Cost $125

KRAM — Keyed Random Access Method — The new, ultra-fast access method for the PET Disk, provides keyed retrieval/storage of data, in either direct or sequential mode, by either full or partial key values. 6502 coding
KRAM 1.0 (logical delete) *$79.95 for PET*
KRAM 2.0 (physical delete) *$99.95*

ANDERSON JACOBSON

841 I/O Terminal Ideal for word processing and small businesses.

Parallel $1130
Serial $1230

- ASCII Code
- 15 CPS Printout
- High Quality Selectric Printing
- Reliable heavy duty mechanism
- Completely Refurbished by A.J.
- Delivered FREE to nearest service center

ATARI Computers & Disks





ATARI 800 Personal computer

Now In Stock!

ATARI 400 Personal Computer

NEW

XYMEC 1000 with QUADRA-PITCH $1295

- Z-80 Controlled
- Up to 198 Columns
- 30 CPS • Reverse Print • Electronic Digital Display
- Multi-Lingual

Automatic recall

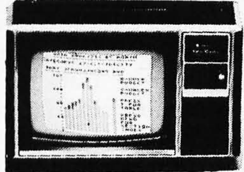
10, 12, 15 Pitch & Proportional Spacing

The XYMEC HY-Q 1000 is "Tomorrow's Printer" - with virtually every advancement built in as standard. No other options are required. Its versatility matches your output format - and - it can be used as an off-line typewriter



FREE

$35 of Software with purchase of any computer on this page.



TEXAS INSTRUMENTS TI-99/4 HOME COMPUTER

Only $1095 Includes 13" Color Monitor!

RADIO SHACK • PET • SORCERER • APPLE • COMPUCOLOR • ETC.

PRINTERS • PRINTERS • PRINTERS

The COMPUTER FACTORY'S extensive inventory and wide selection of computer printers assures you of finding the printer best suited for your needs and specifications. The following printers work well with all known personal computers.

Centronics 779	$1095
Centronics 730	795
Trendcom 100	375
Paper Tiger 440	1095
Xerox 1740	2895



Min Credit Card Order $75



Open Mon.-Fri. 10-6 Sat. 10-4

N.Y. residents add 8% sales tax
• Same day shipment on prepaid and credit card orders • Add $5 shipping for computers, $3 for boards, $1 each cassette tape.

Over 1000 software tapes, books, disks, on display. Come in and browse.

TO ORDER CALL (212) 687-5000

The COMPUTER FACTORY 485 Lexington Avenue 750 Third Avenue (46th St.) New York, N.Y. 10017
Foreign order desk - Telex 640055

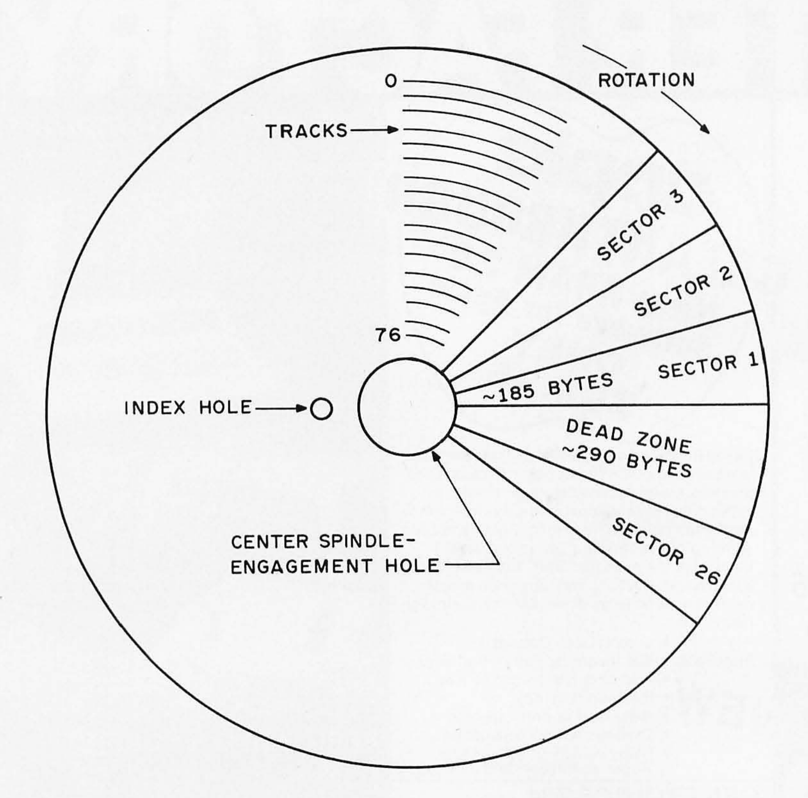


Figure 3: *Format of data storage on a soft-sectored, 8-inch floppy disk, viewed from the side that faces the pressure pad.*

head can read the data. (Large 8-inch disks spin faster than the smaller 5-inch disks.) The higher the density, the more data can be transferred in a given interval of time. Format differences can account for different effective transfer rates on large records, but will not be dealt with in this simulation. I will deal primarily with the standard IBM 3740 soft-sectored, 8-inch floppy-disk format.

Building the Simulation

We now have an understanding of what happens when a function of the floppy-disk drive is requested. We can now construct a program framework that will use this information. To read or write a record, we must pass through four distinct states: head-loading, track-seeking, rotational-latency waiting, and data-transferring. To compute the actual time required to pass through these states, we must get some information from the manufacturer's specifications for a given drive. Typically, the manufacturer will list the time for head load, track step, average latency, and sector transfer in milliseconds.

Head-load time calculation is easy. Each time that the head is loaded, a value corresponding to the head-load time is added to a total-time accumulator. As a matter of practice, most drives and control software leave the head loaded for a fixed-time interval following a disk operation. This reduces head-loading delays and acoustic noise, but it also increases disk surface wear slightly. For most programs (such as assemblers) that engage in almost continuous disk activity, the head will probably go through the load cycle only once during an execution of the program.

Computation of track-step time is not difficult in most cases. We merely figure the number of steps we must make from the current track to the desired track, and multiply that value by the specified track-step time. Do not forget to add the *settling* time, if the manufacturer gives it. (Remember that the settling time indicates the time taken by the head to stop vibrating from its track seeking and to start reading.)

Thus, for disk drives using stepper

Diagnostics I for CP/M* & TRSDOS‡

Someday your computer is going to break; even the most reliable computer systems "go down". Often, finding exactly what is wrong can account for the most time consuming part of repairing the system, and the longer the system is down, the more money you lose.

DIAGNOSTICS I is a complete program package designed to check every major area of your computer, detect errors, and find the cause of most common computer malfunctions, often before they become serious. For years, large installations have run daily or weekly diagnostic routines as a part of normal system maintenance and check-out procedures.

DIAGNOSTICS I is designed to provide that kind of performance testing for 8080/Z80 micro computers.

DIAGNOSTICS I will really put your system through its paces. Each test is exhaustive and thorough. The tests include:

- Memory Test
- Disk Test
- Printer Test
- CPU Test (8080/8085/Z80)
- CRT Test

To our knowledge, this is the first CPU test available for 8080/Z80 CPU's. Many times transient problems, usually blamed on bad memory, are really CPU errors.

A good set of diagnostics is an indispensable addition to your program library even if your system is working fine. Hours have been wasted trying to track down a "program bug" when actually hardware was to blame!

DIAGNOSTICS I also allows you to be confident of your system. This can be critical when file merges or sorts and backups are involved. You want to be as sure of your computer as possible during these critical times. Running DIAGNOSTICS I prior to these and other important functions helps to insure that your system is operating at peak performance.

DIAGNOSTICS I is supplied on discette with a complete users manual.

DIAGNOSTICS I: $50.00
Manual: $15.00

Requires: 24K CP/M; 16K disc for TRS-80
formats: CP/M 8" SOFT SECTORED, NORTHSTAR CP/M AND TRS-80 DOS

All Orders and General Information:
SUPERSOFT ASSOCIATES
P.O. BOX 1628
CHAMPAIGN, IL 61820
(217) 344-7596
Technical Hot Line: (217) 384-0847
(answered only when technician is available)

Give your computer a "physical" today!

VISA · master charge THE INTERBANK CARD



SuperSoft
First in Software Technology

motors, the seek time is the absolute value of the distance from the current track to the desired track multiplied by the track-step time, all added to the settling time, or:

$$T_{seek} = ABS(P_{current} - P_{desired}) \times T_{step} + T_{settling}$$

where T is used for values of time, and P shows the position of the head in relation to data tracks on the disk.

But what should be done when the disk drive uses the linear-type motors to move the head from track to track? The specification sheets for the PerSci unit give only a single-track seek time of 10 ms. Is that the same as the stepper-motor drive timing? No—this timing is for a single-track step, and there is no settling time to be added. In fact, if the two-track seek time is measured, it is one and one-half times the single-track seek time. If a ten-track seek is measured, we find that it takes only three times as long as moving the head a distance of one track.

Well then, what can be done about this device? For this simulation, my plan of attack was direct. I merely measured the time that it took for all possible seek distances (seventy-six values) and then computed an approximating function by using a least-squares polynomial curve-fit calculation. The concepts behind this computation are not simple. Fortunately, the routine is adaptable from a book that addresses such problems, *Data Reduction and Error Analysis for the Physical Sciences* by Philip R Bevington (McGraw-Hill Book Company Inc, 1969).

When the seek time for the PerSci drive is needed in my simulation, the number of tracks the head crosses is evaluated and is given as an argument to the empirically derived seek-time function. The result of the function evaluation is the number of milliseconds required to complete the seek. Thus, the PerSci drive becomes a special case in the simulation, but handling it is not so awkward.

To compute the rotational latency, one of two possible techniques is employed. For any large number of discrete read operations, the actual, average rotational latency experienced will approach one-half of the maximum latency. This value can be used for each read operation as a typical latency. I prefer to calculate a random latency for each read operation. Approximately the same results will appear as in the first method for a large sampling of read operations. You will notice that the results from using random latency values are not likely to be the same each time the program is executed. This is due to the accumulation of random variability, which is an effect you would see if the simulation were carried out on real hardware as well as in a program. The function for randomly determining a latency time is simply: the value of the maximum latency multiplied by a random number between 0 and 1.

The final item which must be dealt with is the actual time it takes the drive to transfer the data to (or from) the disk. The time to transfer 128 bytes of data has been chosen for this simulation. The time values for each drive in this simulation were calculated based on the rotational speed and data density. Record overhead bytes and interrecord gaps were not considered. In the simulation program, the computed values are reflected in the appropriate field in DATA statements that describe the characteristics of each drive. Transfer time for *n* bytes is calculated by multiplying *n* by 8, and then dividing by the *transfer rate*, in bits per second.

About the Simulation Program

Now that we understand the basic drive mechanics, there should be no difficulty in comprehending how the simulation works. The program performs two simulations for each disk drive under consideration.

The first simulation is a set of 500 sequential-read operations, as you would find in a sequential file-copy operation. The second simulation involves a random reading of 500 records, as you might encounter in a program that reorganizes an indexed file according to an unordered secondary key field.

These two modes of access will exhibit the characteristics of general interest concerning floppy-disk drive performance. Briefly, the program steps through the DATA statements that supply the drive name and parameters for that drive. Both simulations are run for a given drive,

Large System *Performance* / Small System *Price*



North Star Horizon Hard Disk COMPLETE Timesharing Computer Systems

by

Micro Mikes, Inc.

Another minor miracle in advanced microcomputer technnology is sending shock waves reverberating throughout the microcomputer and minicomputer industry. Micro Mike's interrupt-driven, bank-switching **North Star Horizon timesharing** coupled with **Shugart 26 megabyte** (29 megabyte, unformatted) **hard disk unit(s)** has sent the nearest competitors scrambling back to the drawing board.

Now as many as **seven users**, each with 32K to 56K RAM,††† can **simultaneously** use the same North Star Horizon computer. As many as ***four 26 megabyte*** (29 megabyte, unformatted) **Shugart** Winchester-type, sealed-media **hard disk units** can be used *in conjunction with* the Horizon's 5¼" minifloppy drives, providing users access to more than ***105 million*** **characters** (formatted) of stored information in a *flash*.

Virtually any **North Star BASIC** program, in any precision of **BASIC**, will run with **TIMESHAVER** ™, Micro Mike's timesharing/hard disk operating system. Each user is allotted a specific bank of memory for that user's individual use. With each memory bank operating independently, each user may *simultaneously* run a different program.

The standard real time clock and vectored-interrupt header features of the **North Star Horizon** computer's motherboard make Micro Mike's interrupt-driven, bank-switching timesharing scheme a natural evolutionary progression of the Horizon's foresightful engineering.

The **Shugart SA4008** double-platter, winchester-type, sealed-media **hard disk drive** is interfaced to the Horizon via a single S-100 buss controller card. The hard disk drive employs eight read/write heads while the controller communicates with the buss through three I/O ports (command, status and data) for ***lightning-quick*** data transfer.

Through **JOEDOS**, ™ Micro Mike's hard disk operating system, each drive may be considered to be one drive or divided into many different "segments" (for convenient backup and separation of different user's files). As many as four of these 26 megabyte units can be operated with the same controller card.

Four-User North Star Horizon/Hard Disk *COMPLETE* Timesharing Computer System

One **North Star Horizon** computer, including: 48K RAM per user (as much as 56 K RAM, optional). Fully populated motherboard. Two 360K quad capacity 5¼" disk drives (as many as four, optional)

Four **Zenith Z19** intelligent (Z80-based) CRTs.

Two Printers: One **Texas Instruments TI 810** dot matrix, 150-character per second, bi-directional tractor pin feed printer with **all available options.**

One **NEC Spinwriter** document-quality, 55 character per second, full character printer with friction feed and tractor pin feed.

One **Shugart 26 megabyte** (formatted) Winchester-type, sealed-media **hard disk unit** with S-100 buss controller, power supply, cabinet, all cables, ports and connectors, interfaced to **BASIC** through Micro Mike's interrupt-driven, bank switching timesharing/hard disk operating system, **TIMESHAVER** ™ (as many as four 26 megabyte hard disk units, seven users, optional).

All cables, ports and connectors required for operation.

Ten 5¼" diskettes, — *and*

†**Micro Mike's Program Library** membership.

Total System (including Program Library Membership) **$21,497**

Micro Mike's will, for a fee, deliver and set up a system anywhere in the USA. Personal user training and/or custom programming is also available.

Shugart SA 4008 26 megabyte (formatted) Wichester-type, sealed media **hard disk units** completely interfaced through **JOEDOS**,™ Micro Mike's hard disk operating system, to **BASIC**, ready to go, complete with S-100 buss controller, cabinet, power supply, all cables, ports and connectors. As many as *four* 26 megabyte drives can be operated with the same controller card **$5,495**

Additional 26 megabyte drive, cabinet and power supply **$4,495**

Micro Mikes offers a complete selection of top-notch business application software written in **North Star BASIC** around a "skeleton" program, **CSUB** (Common **SUB**routines). Among comprehensive CSUB-based business application program packages offered:

Programs included in **Micro Mike's Program Library are indicated by** (†) They are also available separately. These are: †General Ledger †Accounts Receivable †Accounts Payable †Inventory †**CSUB** (Common **SUB**routines) †Payroll †Mail List/Directory Sort †Word Processing/Text Editing †Project Cattle Profits †Timesharing (for the Horizon) †Double density/quad capacity **8" drive interface to DOS and BASIC (DOSCHG)** and † Commodities Charts. †Many more as they are developed, plus hundreds of outstanding utilities programs, games and public domain programs.

Programs indicated by (•) shown below are not included in **Micro Mike's Program Library**, and are available separately. They are: • Time and Expense Package for Accountants, Attorneys and other professionals • Patient Daily Record Program (Doctor/Patient Ledger) for Physicians • Land Subdivision Package • Pharmacy • Hotel/Motel Reservation with Night Audit • Banker's Trust • Feedlot Package • Oil and Gas Producer's Package and • Builders Job Cost Package.

IN STOCK:

North Star Horizon computers

Zenith Z19 intelligent CRTs (Z80 based)

Shugart SA 4008 26 megabyte (formatted) **hard disk units** with S-100 controller card, interfaced to **BASIC**

DISCUS ™ double density and quad capacity **eight inch disk drives** complete with S-100 buss controller, interfaced to **DOS, BASIC and CP/M** ™ (optional) (512K to more than one megabyte each, formatted)

Printers: NEC Spinwriter, IDS-440 Paper Tiger, Texas Instruments TI 810 and TI 820.

Used **Intertec Intertube** CRTs, Closeout **$495**

---

†††Using 56K RAM per user may involve "wasting" or turning off as much as 8K RAM per user. The present maximum number of 56K RAM users is four. As many as seven 48K users can presently be supported.

Prices are subject to change without notice

Complete North Star Horizon Service Center

Call or write for descriptive literature

MMike's

Micro Mike's, Inc.
905 South Buchanan
Amarillo, Texas 79101 — USA
Telephone: (806) 372-3633

Making technology uncomplicated...for People

Circle 80 on inquiry card.

and the results are printed. Look at the program shown in listing 1 to see the simple logic and computations.

Results and Notes

If this simulation were run using a true random-number generator, you would find that the resulting timings will vary on each run. As noted earlier, this is random variation that is to be expected. Do not expect to see exactly the same results as printed here; the values *will* be within a few percent on all runs.

Referring to the simulation output shown in listing 2, observe that, on sequential-read operations, the transfer times for the 5-inch floppy-disk drives are about 25% slower than the times for the standard size (ie: 8-inch) drives. Allowing for random variation, this is very close to the 20% speed difference that might be predicted based on the different rotational rates of the two sizes of floppy disks. The 8-inch disk drives also outperform the 5-inch drives during random-access operations. Most, but not all, of the smaller drives are slower in seeking from track to track, and this really shows during random access.

The fastest-seeking drive of the group, the PerSci Model 277, does not get a chance to show off while reading sequentially, but its capability becomes apparent during random-access operation. This device really moves the head fast! The second and third places go to the Memorex Models 552 and 550 respectively; these use fast stepper-motor drives.

Now that you have read this far, I can reveal some bad news concerning this simulation. The timings obtained are not likely to be a true indication of how long it would take to actually perform these operations on a running computer system. Accomplishing so realistic a simulation involves additional simulation of the interface

Listing 1: *Program to simulate mechanical characteristics of various 8-inch and 5-inch floppy-disk drives, written in BASIC-E and running under the CP/M operating system. One step is the simulation of 500 sequential-read operations; the other is the simulation of 500 random-access read operations. Due to the use of random numbers, some variation of results is expected between different executions of this program.*

```
REM  PROGRAM TO COMPARE ACCESS TIMES OF VARIOUS FLOPPY-DISK DRIVES FOR
REM  SIMULATED SEQUENTIAL AND RANDOM READING.
REM
REM  THE FIRST TEST IS FOR 500 SEQUENTIAL READS, 128 BYTES PER READ.
REM  STARTING TRACK IS 0. THE HEAD IS LOADED AND REMAINS LOADED.
REM  WHERE A DRIVE HAS SECTORS GREATER THAN 128 BYTES, THE SECTOR TRANSFER
REM  RATE HAS BEEN ADJUSTED IN THE DATA FOR THAT DRIVE.
REM
REM  ALL TIMES ARE IN MILLISECONDS.
REM
READ DRIVES                           REM GET NUMBER OF DRIVES TO SIMULATE
INPUT "ENTER ANYTHING TO SEED THE RANDOM-NUMBER GENERATOR";A$
PRINT : PRINT : PRINT                 REM UPSPACE A FEW LINES
PRINT TAB(30); "FOR 500 READ OPERATIONS"
PRINT TAB(25); "DRIVE SPEED COMPARISON SIMULATION"
PRINT TAB(30); "ALL TIMES IN MILLISECONDS"
PRINT
PRINT "DRIVE NAME"; TAB(25);"SEQUENTIAL";TAB(40);"RANDOM"
PRINT TAB(25);"------------- + -------"
PRINT
RANDOMIZE                             REM SHAKE UP RANDOM-NUMBER GENERATOR
FOR D=1 TO DRIVES
    READ DNAME$,TTRK,TSETL,HLOAD,LATENCY,SECREAD,NSECS,NTRKS
    CURTRACK=0                        REM STARTING TRACK
    TOTALTIME=0                       REM SET TIME ACCUMULATOR TO 0
    REM LOAD THE HEAD ONCE FOR THIS SEQUENTIAL TEST
    GOSUB 1000                        REM GO ACCUMULATE HEAD-LOAD TIME
  FOR I=1 TO 500                      REM 500 SEQUENTIAL READS LOOP
    GOSUB 2000                        REM STEP TO NEXT TRACK IF NEEDED. ACCUMULATE TIME
    GOSUB 3000                        REM READ NEXT RECORD. ACCUMULATE TIME
  NEXT I
  REM  PRINT RESULTS FOR TEST 1
  PRINT DNAME$;TAB(28);INT(TOTALTIME*10)/10;TAB(40);
  REM  NOW FOR 500 RANDOM READS IN A FILE 35 TRACKS LONG
  TOTALTIME=0                         REM SET TIME ACCUMULATOR TO 0
  LOWTRACK=0                          REM LOWER FILE TRACK LIMIT
  HIGHTRACK=34                        REM UPPER FILE TRACK LIMIT
  CURTRK=0                            REM START AT TRACK 0
  FOR I=1 TO 500                      REM 500 RANDOM READS LOOP
    NEXTRK=LOWTRACK+INT(RND*35)             REM NEXT RANDOM TRACK
    TRACKSTOMOVE=ABS(CURTRK-NEXTRK)         REM NUMBER OF TRACKS TO TRAVERSE
    GOSUB 2500                        REM COMPUTE TIME TO DO SEEK. ACCUMULATE IT
    GOSUB 3000                        REM COMPUTE RECORD READ TIME. ACCUMULATE IT
    CURTRK=NEXTRK                     REM NEXT TRACK HAS BECOME THE CURRENT TRACK
  NEXT I
  PRINT INT(TOTALTIME*10)/10          REM PRINT RANDOM READ RESULTS
NEXT D
STOP
REM  SUBROUTINES FOLLOW
1000 REM ACCUMULATE HEAD-LOAD TIME
```

Listing 1 continued on page 140

PROGRAM STORE (202) 337-4691

4200 Wisconsin Ave. NW P.O. Box 9609 Washington D.C. 20016

IF YOU'RE LOOKING FOR PROGRAMS GIVE US A CALL. WE SUPPORT ALL RADIO SHACK TRS-80 MODELS, THE ATARI 400 & 800, AND APPLE COMPUTERS. OR, VISIT OUR STORE WHILE IN WASHINGTON.

Credit card callers may phone us 24-hours a day at (202) 337-4691.

****

These programs, unless otherwise indicated, are for the 16k, Level II TRS-80.

Galactic Trilogy

by Douglas Carlston

This trilogy is one of "the hottest new games of the Eighties" says Softside. "Galactic Empire" is a sophisticated game of strategy and tactics of trying to unify the three dimensional universe. As in all the games, the universe is randomly created for a new challenge each time you take control of the Galactica.

After peace is declared, "Galactic Trader" starts. Now as on outcast you barter Microbes, Feelies and other commodities to gain riches and power. But, watch out for assassins and the energy cartel.

"Galactic Revolution" is a game of tactics, diplomacy, social manipulation, and Machiavellian ruthlessness. Unlike the other two in the series, you can play with more than one player and there are sound effects.

Start with any of the Galactic Trilogy today for $14.95 each.

Dunjonquest

THE TEMPLE OF APSHAI

from Automated Simulations

This first in the DunjonQuest(tm) series, lets you take your hero into a magical and mythical labyrinth of over 200 rooms which is populated by over 30 kinds of fearsome monsters who guard over 70 varied treasures. Some of the treasures are magical and can help you in exploring the underground complex, but look out for monsters and traps that spring at you from the walls and shadows of the rooms and passages you traverse. The Book of Lore fills in the background and describes the appearance of the temple as you go. You combat monsters, move, and grab treasure in real-time. Bring in characters from other fantasy role playing games, or let the innkeeper find thee a hardy fellow. Test your mettle against the servants of evil! For D&D players, serious gamers. $24.95 with Book of Lore. On disk, $29.95 -"Temple of Apshai"

Also available are "Datestones of Ryn," the microquest which is the introduction to the Dunjonquest series and "Morloc's Tower," the deadliest of the series. $14.95 on tape, $19.95 on disk, each.



PACKER

by Cottage Software

This is the ultimate editing tool for BASIC program lines. There are five commands which allow easier reading of BASIC programs and more efficient execution by the computer.

The 'unpack' command breaks multiple statement lines into single statement lines with extra spaces for easier reading and editing. The 'short' command deletes any unnecessary words like LET and all REMarks.

The 'pack' commmand compresses lines into multiple statement lines up to the maximum length you specify while maintaining complete program logic. This can easily reduce the memory requirement by more than 33%! As you can imagine this also speeds up execution of a program, saves time in loading a program from either tape or disk and saves disk space.

And the 'move' command allows you to move any section of your program to a new location. With the 'renumb' command you can renumber your BASIC lines.

So if your programs need more memory, or you need more time, order your 'packer'! 16k, 32k and 48k versions supplied on two cassettes for $29.95.



SYSTEM SAVERS

by Tom Stibolt from Acorn

If you ever use the SYSTEM command, you should buy this two program package. These programs allow you to save any system format tape on tape or disk, plus offer several features for machine language programmers. Many two part, protected system tapes like Sargon II are not system format.

With FLEXL, which is one of the two programs, you can make back-up copies of any system format tape. Most often a cassette that you make will load easier than an original. Plus you can find the filename on any system tape because it is displayed on the screen. And at any time you can stop the reading of the tape by pressing <BREAK>.

For any machine language programmer, FLEXL offers the advantage of producing more efficient tapes than the assembler. Also, it is written to interface directly with monitor programs. And you can merge machine language tapes into one file.

Disk drive owners can use TDISK to save any system format tape onto disk. Adventure, Airaid, Ting-Tong, Editor / Assembler and other programs cannot normally be loaded to disk using TRSDOS. Now, TDISK allows you to save these programs onto disk. After DOS READY you will be able to simply type the filename and be up and running. It even loads non-contiguous tapes. TDISK will greatly increase the benefit of owning a disk drive.

And as a FREE BONUS, Acorn provides instructions on how to load MicroChess 1.5 onto disk.

Complete your system with the routines not found in either Level II or DOS for only $14.95. Order your System Savers, today!

TRS-80 DISK & OTHER MYSTERIES

by H.C. Pennington

We don't usually list books, but this one is so unique that we thought you would want to know about it. There are over 100 pages about how DOS works, how a disk is organized, and how to recover from errors. This is THE technical backup for NEWDOS+ with great illustrations. $22.50.

DISK*MOD

by Roy Soltoff from Misosys

This machine language program modifies your copy of the Radio Shack Editor/Assembler for use with your minidisk and any disk operating system. You can save and load both text source and assembled object files. Unlike the NEWDOS+ version you can read the directory and the allocation of granules while in the EDTASM. You can also kill files. It is a complete disk modification for one or more drives.

Other capabilities are also added which are not found on NEWDOS+. The block move command relocates a section of text to any other area. The global change command permits, for example, changing a label throughout the text. The pagination feature provides hardcopy on 8 1/2 by 11 pages on either single sheets or continous paper. In addition, high memory can be reserved, like in BASIC, for machine language routines like printer drivers. You can also display the amount of memory remaining.

The <CLEAR> key is functional, the symbol table is sorted alphanumerically and output 5-across, the scroll up/down allows 15 lines on the screen, and the 'DEFM' assembly is improved. Lower case input is now permitted and you can branch to any address. Plus, it also corrects the errors in the Radio Shack tape version. $19.95

Also available for $239.95 for the TRS-80 Model II is a similar Editor Assembler from Galactic Software. Write for a complete list of Model II software.

DISASSEMBLER

by Roy Soltoff from Misosys & Acorn

This two-pass Z-80 disassembler produces symbolic labels with output to either the video monitor, printer or tape. Radio Shack's Editor / Assembler can load the tapes. If you own the Editor/Assembler, complete the package with this program. Program on tape for two different memory locations.

Cassette version NOW only $14.95

Version which creates disk files $19.95

THE PROGRAM STORE
4200 Wisconsin Ave NW
PO Box 9609 Dept B9
Washington, D.C. 20016

master charge — VISA

☐ YES, please send me these TRS-80 programs:

title	price
postage:	$ 1.00
total:	

name:

address:

city, state & code

☐ check payable to The Program Store

☐ MASTERCHARGE mc bank code:

☐ VISA exp date:

card number:

signature:

Listing 1 continued:

```
  TOTALTIME=TOTALTIME+HLOAD
  RETURN
2000 REM COMPUTE SEQUENTIAL TRACK READ-SEEK TIME
  IF I/NSECS NE INT(I/NSECS) THEN RETURN       REM NO TRACK ADVANCE
2500 IF TTRK=0 THEN 2800                        REM USE SPECIAL PERSCI FUNCTION
  SEEKTIME=TRACKSTOMOVE*TTRK+TSETL              REM COMPUTED SEEK TIME
2600 TOTALTIME=TOTALTIME+SEEKTIME
  RETURN
2800 REM PERSCI-277 DERIVED SEEK TIME FUNCTION
  IF TRACKSTOMOVE=0 THEN :                      REM NO MOVEMENT REQUIRED
    SEEKTIME=0:                                 REM THEREFORE SEEKTIME IS ZERO
    RETURN
  X=TRACKSTOMOVE
  SEEKTIME=10.89605+2.178647*X-4.846975E-2*X*X+7.936448E-4*X*X*X-4.406022E-6*X*X*X*X
  GOTO 2600
3000 REM COMPUTE RECORD READTIME INCLUDING ROTATIONAL LATENCY
  RNDLATENCY=INT(RND*LATENCY)                   REM RANDOM ROTATIONAL LATENCY
  TOTALTIME=TOTALTIME+RNDLATENCY+SECREAD  REM ACCUMULATE READ TIME
  RETURN
REM  FIELD ORDER IN DATA STATEMENTS
REM  DRIVE NAME, TRACK-TO-TRACK TIME, SETTLING TIME, HEAD-LOAD TIME,
REM  MAX LATENCY, TRANSFER TIME, SECTORS PER TRACK, TRACKS PER DISK
DATA 12                                REM NUMBER OF DRIVES TO SIMULATE
DATA "PERSCI 277",0,0,40,166.7,4.096,26,77
DATA "REMEX RFD 1000A/B",6,24,50,166.7,4.096,26,77
DATA "SHUGART SA800",8,8,35,166.7,4.096,26,77
DATA "SHUGART SA400 MINI",40,10,75,200,8.192,18,35
DATA "SHUGART SA450 MINI",25,15,50,200,4.096,18,35
DATA "PERTEC FD200 MINI",25,10,35,200,8.192,16,35
DATA "ICOM FD3800 DUAL-DENSITY",10,0,40,166.7,2.048,26,77
DATA "ICOM MICROFLOPPY",40,10,75,200,8.192,16,35
DATA "MEMOREX 550",6,10,35,166.7,26,77
DATA "MEMOREX 552",3,15,35,166:7,26,77
DATA "MICRO PERIPHERALS B51 MICROFLOPPY",5,15,35,200,8.192,16,40
DATA "ALTAIR 88-DCDD",10,10,45,166.7,4.096,32,77
END
```

and software delay characteristics. However, the relative standing of the drives is unlikely to change if these factors are included.

The important elements to consider for additional simulation are: the record formats on the disk, the interface and controller characteristics, processor speed, and the algorithm of the program performing the access.

As an example of the discrepancy between the simulation and the speed of the total system, I offer the following. My system uses a Z80 microprocessor running at a 2 MHz clock rate, and contains 24 K bytes of zero-wait-state memory. The drive controller, designed by George Morrow, connects to a PerSci Model 277 with the fast-seek option. The operating system is CP/M. The time to read 500 records sequentially using BASIC-E is 109 seconds; to read 500 records randomly takes 525 seconds. Compare these times with those in the results of the simulation for the PerSci drive. Beware of making system estimates based only on a part of the total operation. Does anyone want to write an article that describes operating-system timing simulation?

Listing 2: *Output of simulation results produced by the program of listing 1.*

FOR 500 READ OPERATIONS
DRIVE SPEED COMPARISON SIMULATION
ALL TIMES IN MILLISECONDS

DRIVE NAME	SEQUENTIAL	RANDOM
PERSCI 277	43107.6	57912.2
REMEX RFD1000A/B	43650.1	92281.9
SHUGART SA800	44163.1	94881.9
SHUGART SA400 MINI	53547.8	288397.1
SHUGART SA450 MINI	55153.2	198631.3
PERTEC FD200 MINI	52804.8	201703.6
ICOM FD3800 DUAL-DENSITY	43110.0	101456.6
ICOM MICROFLOPPY	55698.8	293376.0
MEMOREX 550	44821.1	77892.1
MEMOREX 552	44000.1	66670.3
MICRO PERIPHERALS B51 MICROFLOPPY	55287.8	89390.2
ALTAIR 88-DCDD	42634.1	108670.8

Two for One

There are two basic lessons to be learned from this exercise. The first one concerns an elementary introduction to the motions that occur in floppy-disk drives and affect their speed of operation. The second lesson concerns derivation of mathematical functions that describe these mechanical motions; it also concerns putting the functions into a program for the purpose of obtaining an estimate of performance. Performance, for the purpose of this article, considers only the relative speed of operation of the various drives. In making a decision to select a particular floppy-disk drive, you must understand that overall performance, not just speed of operation, should be examined. ■



*Z80 is a registered trademark of Zilog, Inc.
**CP/M and MP/M are registered trademarks of Digital Research, Inc.

ALTOS BREAKS THE MICRO BARRIER.

Yesterday, microcomputer meant micro performance. Once you outgrew it, you had to step up to a mini. Which meant a big step up in price.

Today, there's the new Altos ACS8000-6 single-board microcomputer system.

It's the first system for the OEM, small businessman and personal user, that offers minicomputer performance and minicomputer storage capacities—at a microcomputer price.

MULTI-USER, WINCHESTER STORAGE, FLOPPY BACK UP: $14,260.

The new Altos ACS8000-6 is a highly advanced Z80* based microcomputer system with high-speed RAM, floppy disk and Winchester hard-disk controllers, DMA, six serial and two parallel I/O ports and the AMD 9511 floating point processor all on a single board. A typical four-user system configuration with two megabytes of Shugart floppy and 29.0 megabytes of Shugart Winchester storage, including CPU and 208K bytes of RAM, costs only $14,260—compared to $30,000 or more for a similar minicomputer system. And that adds up to mini performance at less than half the cost!

MULTI-USER EXECUTIVE SUPPORTS FOUR INDEPENDENT USERS RUNNING CP/M COMPATIBLE PROGRAMS.**

This revolutionary new microcomputer system features the MP/M** Multi-User Executive software program that's unique in two ways. It includes a multi-user CP/M capability and the ability to handle Winchester-type hard disks. The advanced Z80 operating program supports four independent CP/M compatible programs in any of six popular languages: BASIC, FORTRAN, COBOL, PASCAL, APL, C, and a large assortment of additional business application packages. MP/M is compatible with both the 1.4 and 2.0 versions of Digital Research's CP/M, which means programs based on either version can run under MP/M without modification.

With MP/M at the helm, your Altos ACS8000-6 system can support up to four simultaneous users with 48K bytes of RAM each plus 58 megabytes of Winchester storage and 4 megabytes of floppy back up. And that adds up to the first microcomputer to give you the power and performance of a minicomputer.

SINGLE-USER, HARD-DISK SYSTEMS START AT $9450.

The Altos ACS8000-6 series. It's a barrier breaker in every sense. Our entry-level, single-user, hard-disc system with floppy back up is priced under $10,000 and even our 4-user CP/M model is available for under $12,000. And all configurations are easily upgraded. For specific details about pricing or performance, call or write:

Altos Computer Systems,
2360 Bering Drive, San Jose, CA
(408) 946-6700. TELEX 171562 ALTOS SNA.

Circle 83 on inquiry card.



BYTELINES

NEWS AND SPECULATION ABOUT PERSONAL COMPUTING

Conducted by Sol Libes

What To Look For At NCC: The computer show of the year is the National Computer Conference (NCC), which will be held this month (May 19 thru 22) at the Anaheim Convention Center in Anaheim, California. In 1979, 60,000 people attended the NCC. Many new products are introduced each year at NCC. The 1980 show will see many more Japanese manufacturers displaying, among other things, 8-inch Winchester disk drives and microcomputer systems. Furthermore, look for several manufacturers from the United States to show complete microcomputer systems that use the Zilog Z8000 and Motorola 68000 16-bit microprocessors. Last year's show saw the introduction of 8086-based microcomputers. Also, look for disk-operating-system-based languages and applications packages for these new 16-bit microcomputer systems. Several multiprocessing and multiuser microcomputer systems will also be shown.

John Mauchly, Computer Pioneer, Dies: Dr John W Mauchly, co-inventor of the digital computer, died on January 8, 1980 at the age of 72. Together with his colleague Dr J Presper Eckert, Dr Mauchly conceived, designed, and built ENIAC, the first electronic digital computer. It was built at the University of Pennsylvania and became operational in 1944. ENIAC contained thousands of vacuum tubes, filled 150,000 square feet of space, and weighed 30 tons. It was used for ten years.

Mauchly and Eckert later formed the Electronic Control Company (later called the Eckert-Mauchly Computer Corporation) to manufacture BINAC (Binary Automatic Computer), which became the prototype for the UNIVAC I (Universal Automatic Computer). The UNIVAC I was the first commercial computer; it was installed at the United States Census Bureau in 1951.

When the company was purchased by Remington-Rand in 1950, Dr Mauchly continued with the Univac Division as Director of Applications and worked on weather-forecasting projects. In 1959 he left to form Mauchly Associates, a consulting firm that developed the critical-path method for construction.

In 1967 he founded Dynatrend, a computer consulting firm, and since 1973 he had served as a consultant to Sperry Univac.

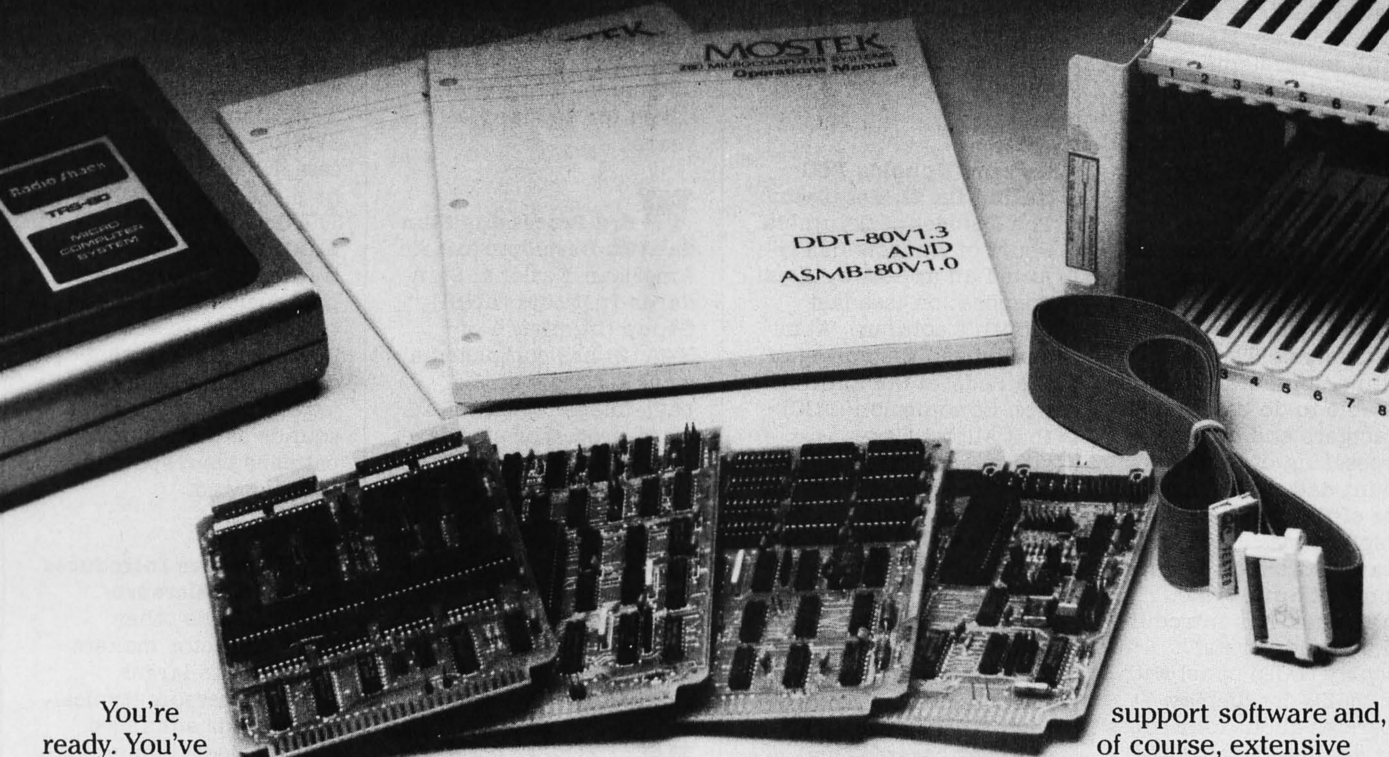
Mauchly and Eckert met in 1941 at the University of Pennsylvania's Moore School of Electrical Engineering, where both were instructors. They first proposed the building of the digital computer to the US Army in 1942 for calculating trajectory tables. ENIAC contained ten accumulators, had internal memory, used subroutines, and was all-electronic, while prior machines were electromechanical and very limited in power. Some parts of ENIAC can be seen at the Smithsonian Institution in Washington, DC.

At the time of his death Dr Mauchly was believed to be working on a word-processor project using a Radio Shack computer. He was an active proponent of personal computing, and he will be missed by many.

News Bits: Friends Amis has developed an interface for the Craig M-100 hand-held language translator that allows the user to add read-only memories containing data bases such as wine lists, Olympic scores, history, or metric conversion.... Panasonic will introduce a hand-held computer to sell for about $180 in late 1980. The RLT500 Electronic Data Center can be connected to a television set for display, to an acoustic modem for communication, to a printer for hard copy, or to a speech synthesizer for audible output. Quasar will bring out the HC2000RA Information Processor for $150, which should work with the accessories for the Panasonic machine.... Amateur robot builders have a new source for parts: Vedos Ltd, Suite 1113, 19 W 34th St, New York NY 10001.

Random News Bits: In last month's column I mentioned a rumor about a new printer to compete with the Sanders Technology word-processing dot-matrix printer. The unit has now been formally announced by Florida Data Corporation of West Melbourne, Florida. It offers up to 900 characters per second (cps) speed with correspondence-quality type and high-resolution graphics (at a slower speed). It is said to use a magnetic stored-energy print head, and to offer an almost unlimited choice of type fonts, full graphics, and extended-character format. The machine will be available in the fourth quarter of 1980, and it should be priced under $2000.... Micro Peripherals Incorporated of Salt Lake City, Utah, plans an under-$1000 word-processing printer using a seventeen-wire matrix head and printing at 60 to 75 cps.... In the meantime Diablo, Qume, and Nippon Electric Company (NEC) are rumored to be developing under-$1000 daisy-wheel printers.... Dataproducts will soon introduce a daisy-wheel printer; some observers speculate that it will sell for 20 to 30% less than current daisy-wheel units.... Next year, General Motors (GM) will make much use of on-board microcomputer systems in its vehicles to

Put your applications to work on the Mostek STD-Z80 BUS.



You're ready. You've gone beyond the learning stage and are using your personal computer to implement real time control applications.

We can take you one big step further. By showing you how to take the programs you have developed using your TRS-80 (or other Z80 based computer) and place them in PROM on a low-cost stand-alone micro card system. This will not only free up your main computer for new applications, but will also permit your current application to be "on-line" continuously, or even "cloned"-for multiple installations or sales to other users.

Mostek's MD Series™ of STD-Z80 BUS compatible microcomputer cards makes all this possible. There are more than twenty different boards in this off-the-shelf family available now, including data processing boards; memory boards (Static and Dynamic RAM, ROM/PROM); I/0 cards; A/D; D/A; high speed floating point math; and floppy disk controller cards.

QC Micro Systems offers all of these products directly, including a full range of support products such as prototyping hardware, support software and, of course, extensive documentation. And much more. Contact us for details so they can be put to work for you, by sending in the coupon below. Today. QC MicroSystems, P. O. Box 401326, Garland, TX 75040, (214) 343-1282.

QC Micro Systems

Yes! I'm ready for more information on the STD-Z80 BUS products from QC MicroSystems. My application is

☐ Personal ☐ Resale
☐ Industrial Control ☐ Other ____
☐ Yes, I would like to use my TRS-80 as my STD BUS development station.

Name ____
Company ____
Address ____
City ____ State ____ Zip ____

Circle 84 on inquiry card.

meet the stringent requirements for emissions control and fuel economy. GM's need for electronic parts will be so great that the company will use 56% of the world's supply of 8 K-byte read-only memories and 40% of the analog-to-digital converters, according to a GM estimate. In all, GM will buy 13 to 15 million electronic parts each day, more than 3 billion parts per year.... Chase Manhattan Bank is developing the Personal Computer Bank Communications System. Any bank customer who has a home terminal or computer system will be able to access (via telephone) his or her account, get an up-to-the-second status report, and cause funds to be transferred. The user with a computer will also be able to do batch-mode transfers and off-line processing of bank account data.... The precursor of flat solid-state data displays may have appeared. Crokroft International of Sunnyvale, California, has introduced a liquid-crystal display (LCD) panel with 32-by-32-dot display. It operates about four times faster than current LCD displays. The company also expects to have a variable-color display in the near future.... For the first time, a microcomputer-software package has been placed on the prestigious Datamation magazine Honor Roll of Software Packages. Naturally, the software package was the CP/M operating system, a product of Digital Research. Microsoft BASIC and UCSD Pascal received honorable mention.... A report from International Resource Development, a management consulting firm, predicts that four billion dollars will have been spent on electronic-mail services and equipment by 1990. The field will be dominated by IBM, AT&T, and GT&E, with the US Postal Service getting about one quarter of the business.... A new supercomputer project has been started. Denelcor of Denver, Colorado, is planning to manufacture a computer that uses 50 processors, capable of performing 500 million instructions per second in parallel.... Texas Instruments and Hitachi are developing 64 K-bit programmable memories, which should become available next year....

Court Upholds FCC Ruling On TI Modulator: The District of Columbia Court of Appeals has rejected an appeal by Atari Corporation (see last month's column). Atari challenged the ruling of the Federal Communication Commission (FCC) that allows Texas Instruments (TI) to sell its stand-alone radio-frequency (RF) modulator while the FCC reexamines its own guidelines for electronic television accessories. Atari argued that the FCC should have forced Texas Instruments to abide by the present rules until changes became final. The present regulations prohibit the marketing of stand-alone modulators. Texas Instruments uses these modulators with its Model 99/4 personal computer system.

Radio Shack And Apple Ask FCC For Deadline Extensions: Tandy Corporation (parent company of Radio Shack) and Apple Computer Company have filed separate petitions with the FCC, asking that the FCC's July 1, 1980 deadline for compliance with new radiation standards be extended. They feel that there could be an adverse effect on products still in dealer stocks, which could take 6 to 9 months to sell. All units manufactured after July 1 will have to comply with the standards. General Electric, General Telephone and Electronic (GT&E) Services Corporation, Honeywell, Control Data Corporation, Atari, American Telephone and Telegraph (AT&T), the Computer and Business Equipment Manufacturers Association (CBEMA), and Electronic Industries Association (EIA) have also filed petitions. Most of these petitioners asked for a 2-year extension, while some asked for as many as 7 years.

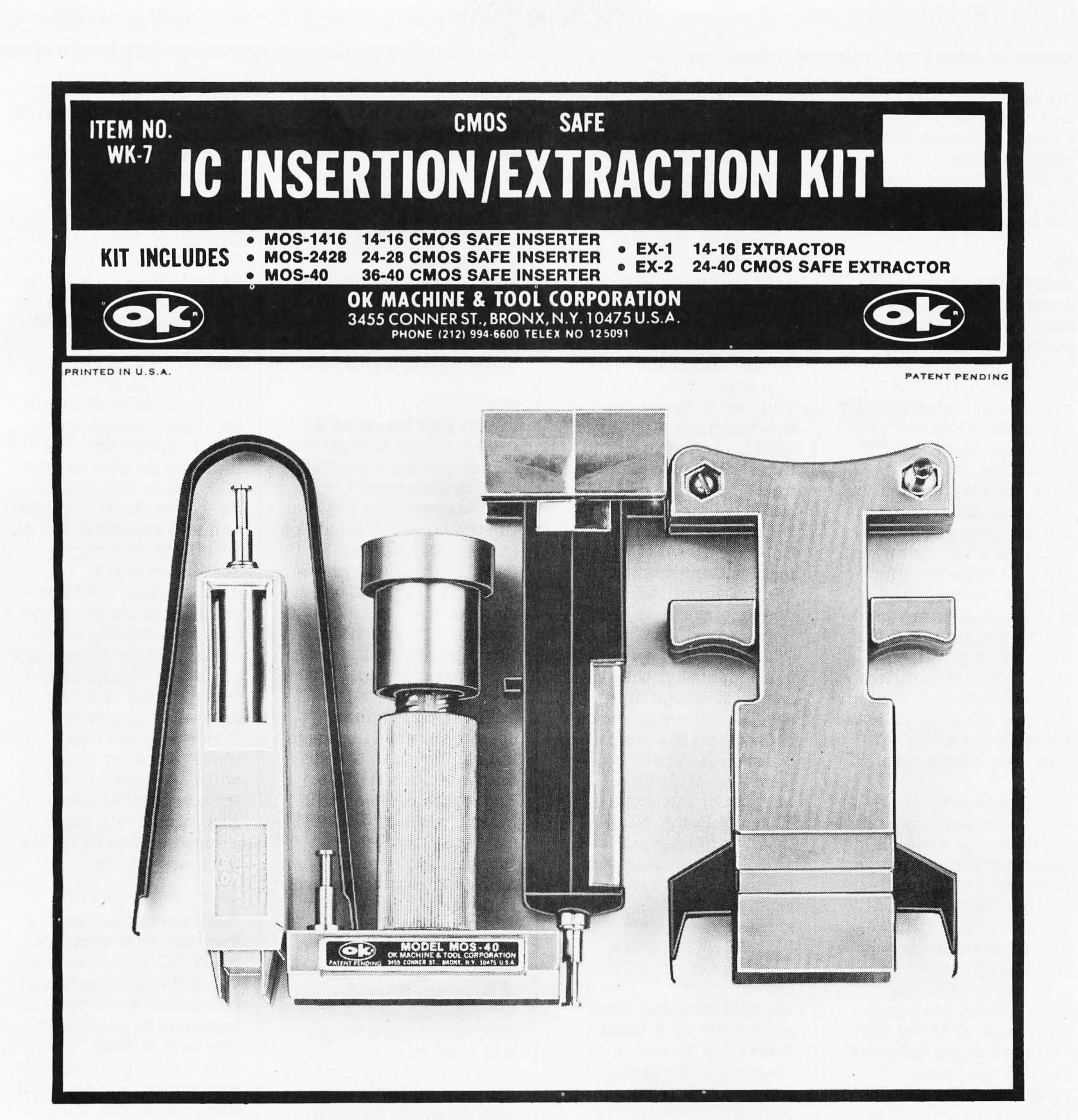
Word-Processing Standard In Development: An American National Standards Institute (ANSI) Group (number 4 of X4A12) has completed a working draft of the page-image format of a word-processor standard. The purpose is to facilitate communications between word processors from different vendors in a common language. The present draft is considered only a first step; the first part of the standard is expected to be adopted by midyear.

Microprocessor Technology Seen Affecting Employment: A report presented at a recent conference of the Organization for Economic Cooperation and Development (OECD) in Paris, France, cited an impact on employment in Japan by microcomputers. The report was prepared by a special committee organized by the Japan Information Processing Development Center and sponsored by the Ministry of International Trade and Industry.

The report forecasts substantial job layoffs due to labor-saving microcomputer-controlled equipment. The biggest effect will be felt in assembly manufacturing where automation will substantially reduce the number of unskilled workers on the assembly line. On the other hand, the report predicted an increased need for systems and software personnel.

Microcomputer Lip-Reader For Deaf: The Research Triangle Institute in North Carolina, working with funds from the National Aeronautics and Space Administration (NASA) and the Veterans Administration, is developing a microprocessor-based system to help the deaf read lips. The device, called Autocuer, can increase a trained lip-reader's comprehension from the typical 25% to about 90%. A light-emitting diode (LED) display projects representations of sounds as nine simple patterns corresponding to the sound.

Commodore Introduces New 4-bit Microprocessor: While other semiconductor makers are going to larger microprocessors (typically 16-bit or enhanced 8-bit devices) Commodore has decided to go in the other direction. Chuck Peddle, the wizard who created the 6502 microprocessor (used in the PET, Apple, Ohio Scientific, Atari, and other computers) and who also created the KIM-1 and PET computers, has now turned his efforts to designing a "super" 4-bit microprocessor called the MCS4500. Using complementary metal-oxide semiconductor (CMOS) technology, it has thirty-four instructions, onboard memory (including 2 K bytes of read-only memory and 176 nybbles of scratch-pad memory), and can directly drive up to four multiplexed liquid-crystal displays (LCDs). Memory can be expanded, and many of



INS-1416	14-16 PIN DIP IC INSERTER	$ 3.49
MOS-1416	14-16 PIN MOS CMOS SAFE INSERTER	$ 7.95
MOS-2428	24-28 PIN MOS CMOS SAFE INSERTER	$ 7.95
MOS-40	36-40 PIN MOS CMOS SAFE INSERTER	$ 7.95
EX-1	14-16 PIN EXTRACTOR TOOL	$ 1.49
EX-2	24-40 PIN CMOS SAFE EXTRACTOR TOOL	$ 7.95
WK-7	COMPLETE IC INSERTER/EXTRACTOR KIT	$29.95

MINIMUM BILLING $25.00. ADD SHIPPING CHARGE $2.00. NEW YORK RESIDENTS ADD APPLICABLE TAX.

OK MACHINE & TOOL CORPORATION 3455 CONNER ST., BRONX, N.Y. 10475 (212) 994-6600/TELEX 125091

Circle 85 on inquiry card.

the features found on 8-bit processors are included. Commodore will offer an assembler and emulator for the device that runs on a PET microcomputer.

IEEE Developing Assembly-Language Standard For Microcomputers: The Institute of Electrical and Electronics Engineers (IEEE) is developing a standard for assembly language on microprocessors (IEEE Task P694/D11). It is long overdue and will be of enormous value to all assembly-language programmers who are struggling to write code for different microprocessors. The group working on the standard has done some genuinely worthwhile things, such as demonstrating that all the current major microprocessors can be handled by a single standard.

The problems of present inconsistency are incredible. For example, in assembly code for some processors, MOV A,B means "move the contents of register B to A," while for others it means just the opposite.

The new IEEE standard should cure problems such as those that occurred when Zilog did not use the Intel mnemonics for the Z80's instructions, which are a superset of the 8080's instructions (probably because Intel copyrighted the mnemonics).

The standard also covers instruction names, address modes, operand sequences, expression evaluation, constants, labels, comments,and assembler directives. The standard does not specify the syntax necessary to support macroinstructions or conditional assembly.

The IEEE Computer Society is to be congratulated for its activities in developing computer standards, which are overcoming problems created by companies that all too often intentionally create incompatibilities to protect their competitive position.

I predict that this assembly-language standard will meet with the wide adoption that the other IEEE standards (such as the IEEE-488 interface and IEEE S-100 bus standards) have met. You can obtain a copy of the Assembly Language Standard draft by sending a self-addressed 10 by 13 inch (25.4 by 33 cm) envelope with $0.54 US postage affixed to Dr Robert G Stewart, Chairman of Computer Standards Committee, IEEE Computer Society, 1658 Belvoir Dr, Los Altos CA 94022.

Incidentally, the IEEE is also working on several other standards relevant to the microcomputer area. These projects are: Multibus, Microbus, Futurebus, Floating Point, High-Level Languages, Pascal and Relocatable Object Format. I will try to report on IEEE's progress in a future BYTELINES column.

Telecomputing Companies Off To A Good Start: The Source, a telecomputing service provided by Telecomputing Corporation of America (or TCA, headquartered in McLean, Virginia), is just six months old. The Source has 3000 subscribers and is adding 500 more per week. The company, which provides information retrieval and software services via a telephone network, has grown to thirty-five employees and a monthly revenue of $100,000. TCA is aiming to have 100,000 customers by the end of 1980.

A competing service called MicroNet, provided by CompuServe Incorporated of Columbus, Ohio, is aimed more at the hobbyist. They claim to have 1200 customers already. However, there is a dark cloud on the horizon, in the form of the Teletext and Viewdata systems now being tested by GT&E, Texas Instruments, and others. This may provide much lower cost but less flexible data access to the home television screen.

Flat CRT Unveiled At CES: Sinclair Radionics demonstrated a prototype of their flat-screen cathode-ray tube (CRT) at the Consumer Electronics Show (CES) held in January. Sinclair hopes to use it in a $125 television receiver to be available in late 1981. The electron gun is mounted sideways, with the beam deflected to strike the phosphor-coated screen. The image is brighter than images on conventional CRTs. The entire receiver will measure 2.5 by 10.2 by 12.7 cm (1 by 4 by 5 inches). The company is doing additional research to develop large-screen and color flat CRTs.

Random Rumors: Centronics, the largest supplier of printers today, will soon cut prices 20 to 30% on existing low-cost printers and will unveil new products directed specifically at the personal computer market, including both impact and nonimpact serial matrix units.... Dataproducts, Okidata, and a number of Japanese manufacturers including NEC are rumored working on multipass, high-density, dot-matrix printers to compete with the RC Sanders Technology Systems Media 12/7 printer. However, at present Sanders Technology has about a 2-year lead time on this technology.... Radio Shack might introduce more than one new personal computer system in the late fall (see the February 1980 column for previous rumors).... Reports have been circulating that Data General is developing a desk-top computer, code-named Wing. It will use a microprocessor, have two floppy-disk drives, and will be made in Taiwan.... It is rumored that Toshiba Electric Company is working on an experimental voice-input typewriter. The unit will be able to type 100,000 to 200,000 different words in Japanese and will recognize words with 90% accuracy. Toshiba recently demonstrated prototype voice-activated television and high-fidelity equipment.... More rumors are surfacing regarding the future plans of Apple Computer Company. Reportedly the new model Apple computer will be a Pascal machine for educational users. Also, Apple will place increased emphasis on the business market....

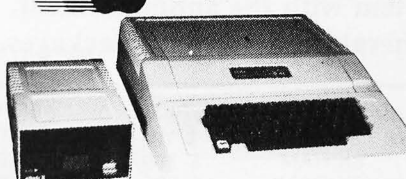
Congress Considering Two Personal Computer Bills: Did you know that two bills about personal computers have been introduced in Congress? One is H.R.3822, which would set up a national endowment for personal computers. The other is H.R.4326, which would create a presidential commission to make recommendations about the personal computer field.

MAIL: I receive a large number of letters each month as a result of this column. If you wish a response, please include a stamped, self-addressed envelope.

Sol Libes
Amateur Computer Group of New Jersey (ACG-NJ)
1776 Raritan Rd
Scotch Plains NJ 07076

››››EXCITING MAIL ORDER DISCOUNTS‹‹‹‹

apple computer II



16K

$959

CASH PRICE

APPLE II 32K $1050
APPLE II 48K $1100

•COLOR •GRAPHICS •SOUND

APPLE II ACCESSORIES

CORVUS 10 MEGABYTE DISK DRIVE	$4650.00
PASCAL LANGUAGE SYSTEM	445.00
GRAPHICS INPUT TABLET	675.00
DISK II with CONTROLLER CARD	495.00
DISK II without CONTROLLER	440.00
APPLESOFT FIRMWARE CARD	155.00
INTEGER FIRMWARE CARD	155.00
SERIAL INTERFACE CARD	160.00
COMMUNICATIONS CARD	190.00
CLOCK/CALENDAR CARD	230
INTROL X-10 SYSTEM	325.00
SUPERTALKER SPEECH SYNTHISIZER	325.00
ROMPLUS CARD	199.00
HEURISTICS SPEECHLINK 2000	225.00
DC HAYES MICROMODEM II	$335.00
ALF MUSIC SYNTHISIZER	245.00
SSM A10 CARD (KIT)	125.00
SSM A10 CARD (A&T)	190.00
NOVATION CAT MODE M	169.00
SUP-R-MOD RF TV MODULATOR	25.00
SUP-R-TERM 80 col. CARD	349.00
DAN PAYMAR lower case kit	45.00
SVA 8'' DISK CONTROLLER CARD	349.00
CCS ARITHMETIC PROCESSOR CARD	349.00
CCS GPIB INTERFACE CARD	269.00
CONTROLLER Gen. Bus. software	529.00
CASHIER Retail Mangmnt. & Inven. soft.	209.00
APPLE POST Mailing List software	45.00
APPLEWRITER Word Processing software	69.00

WE SELL APPLE SOFTWARE ALSO.

ATARI 800™

PERSONAL COMPUTER SYSTEM



$899

ATARI 400 COMPUTER	$499.00
ATARI 820 PRINTER	$499.00
ATARI 810 DISK DRIVE	$599.00
ATARI 410 PROGRAM RECORDER	$69.00
ATARI 16K RAM MODULE	$149.00

- High resolution COLOR Graphics
- 10K Basic in ROM
- 8K user RAM expandable to 48K
- 57 key full stroke keyboard
- Built-in RF TV modulator
- High speed serial I/O port
- Includes ATARI 410 program recorder

WE SELL ATARI SOFTWARE ALSO.

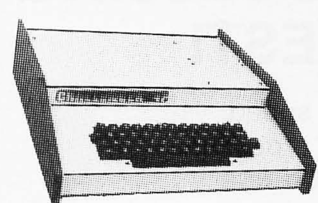
THE AMAZING SORCERER™ BY Exidy inc. $995.00

The SORCERER is a Z80 CPU based micro-computer internally expandable to 48K. 4K ROM resident monitor. I/O connector for S-100 expansion. Parallel and serial interface. Dual cassette I/O. Graphic resolution of 240 x 512. 30 lines of 64 characters. 8 x 8 dot matrix. Full ASCII set (upper and lower case), plus standard graphic symbols. User may define up to 128 characters. Keyboard is 63 key data processing type, plus a 16 key numeric input pad.



32K 1,145.00 48K 1,295.00

OHIO SCIENTIFIC CHALLENGER 4P $649



Featuring.

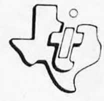
- 8K BASIC in ROM
- 8K Ram expandable to 32K
- 16 COLOR GRAPHICS
- 32 x 64 Upper & Lower case characters
- 256 x 512 High resolution graphic points
- Programmable tone generator 20hz - 20KHz
- Plus more!

CHALLENGER C4P MF
$1589

All the features of the C4P plus...
- A SINGLE MINI FLOPPY DISK DRIVE
- A REAL TIME CLOCK
- SECURITY SYSTEM, MODEM & PRINTER INTERFACE
- 24K RAM expandable to 48K (of reliable static RAM)

WE SELL OSI ACCESSORIES & SOFTWARE ALSO.

Texas Instruments





TI-99/4 $979

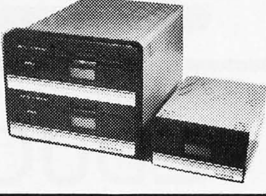
- 16K of user RAM
- Extended BASIC language in ROM
- 16 COLOR GRAPHICS
- Supported with Solid State Software

INCLUDES a 13 inch COLOR VIDEO MONITOR

We sell TI-99/4 Accessories & Software Too.

MICROPOLIS™ MetaFloppy DRIVES

1021 MOD ii	(SINGLE w/o pwr supply or controller)	$529.00
1041 MOD II	(Single w/o pwr supply, w/controller)	899.00
1043 MOD II	(Single with prw supply & controller)	999.00
1053 MOD II	(Dual drives w/pwr supply ? controller)	1649.00



- 315K Bytes storage per drive
- QUAD DENSITY DESIGN
- COST EFFECTIVE STORAGE
- 4 TIMES STANDARD CAPACITY!

SOROC IQ 120



- SERIAL RS232C
- FULL ASCII UPPER/LOWER CASE
- NUMERIC KEYPAD CURSER KEYS
- SCREEN CONTROL & PROTECTED FIELDS

$739

•ALSO AVAILABLE•

SOROC IQ 140 $1195.00

These terminals are shipped freight collect only.

MONITORS



LEEDEX VIDEO 100

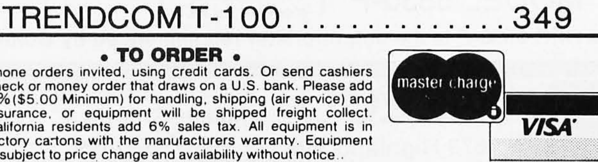
12" BLACK & WHITE MONITOR
- VIDEO BANDWIDTH 12 MHz±3db
- COMPOSITE VIDEO INPUT

$135.00

SANYO 9" Black & White Monitor	$169
SANYO 15" Black & White Monitor	259
ZENITH 13" Color Monitor	399

PRINTERS

PAPER TIGER ITS 440	875
With Graphics Option	1,075
CENTRONICS 730-1	850
CENTRONICS 779-1	1,049
ANADEX DP-8000	850
AXIOM EX-801	495
AXIOM EX-820	795
COMPRINT 912S	599
COMPRINT 912P	559
TRENDCOM T-100	349



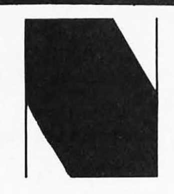
• TO ORDER •

Phone orders invited, using credit cards. Or send cashiers check or money order that draws on a U.S. bank. Please add 3% ($5.00 Minimum) for handling, shipping (air service) and insurance, or equipment will be shipped freight collect. California residents add 6% sales tax. All equipment is in factory cartons with the manufacturers warranty. Equipment is subject to price change and availability without notice.



COMPUTER SPECIALTIES
6363 EL CAJON BLVD., SUITE 205,
SAN DIEGO, CA. 92115 • (714) 579-0330

Circle 86 on inquiry card.

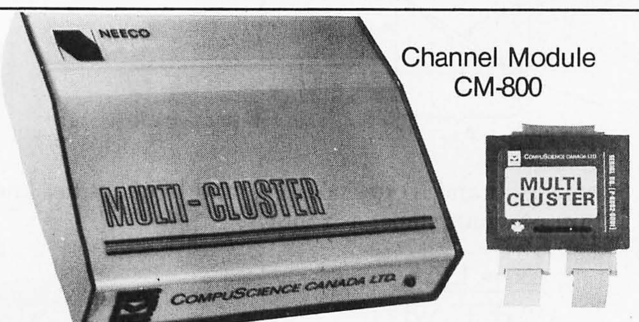


NEECO PROUDLY INTRODUCES

MULTI-CLUSTER

"Multi User Management System for Commodore CBM/PET Computers"*

UP TO 8 CBM/PETS MAY NOW SIMULTANEOUSLY ACCESS ONE 2040!



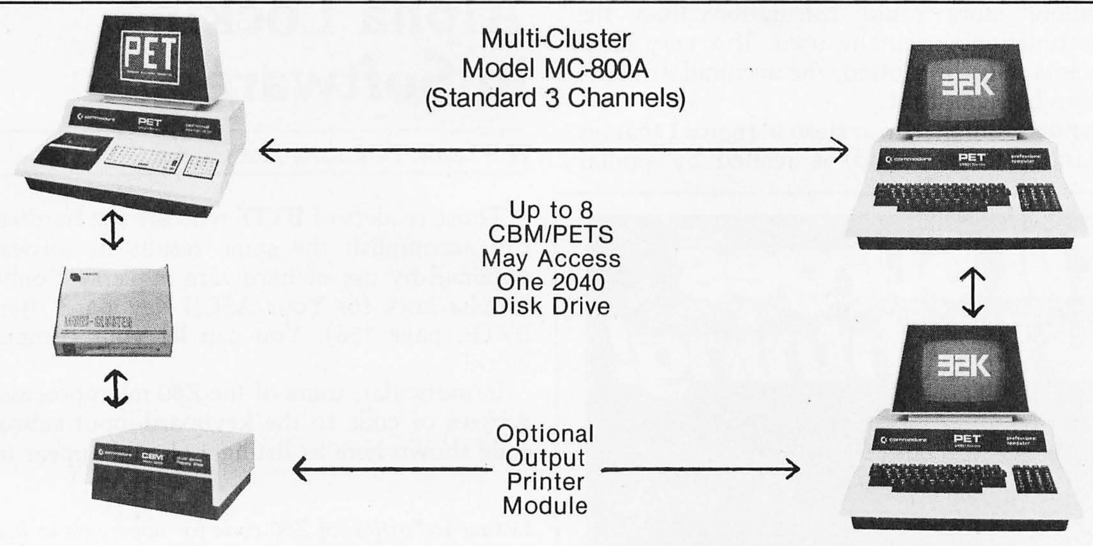
Channel Module CM-800

Multi-Cluster Model MC-800A Standard 3 Channels)

$995

- Up to 8 Channel (3 Standard) for CBM/PET Computers.
- Up to 8 CBM/PETS can multi-use one Commodore 2040 dual disk drive simultaneously with equal access.
- Multi-Cluster supports all 2040 disk O/S commands including sequential, random access, and user files.
- Multi-Cluster does not utilize any RAM or ROM from the 2040 or host CBM/PET units.
- Multi-Cluster is compatible with all known softwear that utilize the IEEE port.
- Multi-Cluster can be fully implemented on 8 PETS, completely ready to use, in less than 15 minutes.
- Simply plug the Multi-Cluster unit into the IEEE port of the 2040 Disk Drive, then attach a Channel Module, #CM800, (3 Channel Modules are standard with unit), to the IEEE port of each PET.

THE MULTI-CLUSTER SYSTEM HAS BEEN USED AND FULLY-TESTED BY NEECO



Multi-Cluster is ideal for industrial, OEM, Vertical Markets, and Educational Institutions. Multi-Cluster allows you to make full use of the Commodore 3 units for the price of 2 educational programs.

Output Printer Module allows 1 CBM/PET to scan 2040 Disk and print flagged files.

Standard Components:

1	Multi-Cluster	#MC800A
3	Channel Modules	#CM-100
3	6′ Ribbon Cables	#RC6

Optional Component Prices:

Each additional CM-100	$250
Each 12′ Ribbon Cable (RC12)	$ 40
Each 18′ Ribbon Cable (RC18)	$ 60
Output Printer Module (PM200) (For Centronics Protocal Printers)	$200

*PET is a registered trademark of Commodore Business Machines. Small Keyboard PETS require a ROM Retrofit Kit for Multi-Cluster system operation.

Multi-Cluster is available in Canada from BMB Compu Science, Milton, Ontario, (416) 878-7277



NEECO
679 Highland Ave.
Needham, MA
02194

Dealer Sales:
Microamerica Distributing
21 Putnum St., Needham, MA 02194
(617) 449-4310 **Telex: 951021**

Customer Sales:
NEECO
679 Highland Ave., Needham, MA 02194
(617) 449-1760

Circle 90 for NEECO

Circle 89 for microamerica

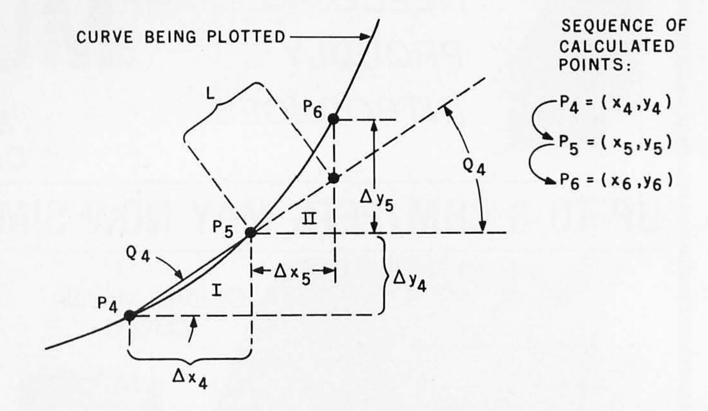
Technical Forum

Simplifying the Curve-Plotting Calculation by Geometric Means

A David Nawrocki, 1101 Wiltshire, San Antonio TX 78209

I enjoyed reading Timothy G Bowker's interesting article "Minimizing Curve-Plotting Calculation" (December 1979 BYTE, page 134). Perhaps it is worth pointing out that his equation (1) on page 138, which involves arctangent and cosine functions, can be reduced to a more efficient form for computational purposes. Although the improvement is slight, the use of a single square-root term will allow more rapid calculation than the trigonometric functions originally used. If a very large number of points must be plotted, the accumulated savings in time can be significant.

First, let us note from the illustration in figure 1 that his Δx_5 (the quantity to be found) is related by similar triangles (I and II) to Δx_4, Δy_4, and L (quantities known from previous steps) as follows:



$$\Delta x_5 = \frac{L\,\Delta x_4}{\sqrt{\Delta x_4^2 + \Delta y_4^2}}$$

The possible scale factors M and N cancel out, and it is not necessary to compute Q_4 to obtain Δx_5.■

Alpha Locking in Software

W S Lewis, POB 1555, East Canton OH 44730

Those readers of BYTE who are not hardware fanatics can accomplish the same results in software as was obtained by use of hardware in Terry Conboy's article "Alpha Lock for Your ASCII Keyboard" (January 1980 BYTE, page 156). You can let your computer do the work!

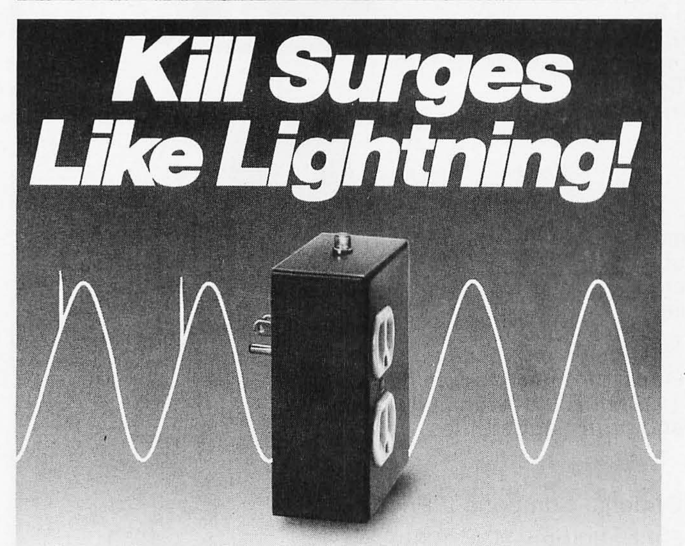
In particular, users of the Z80 microprocessor can add 8 bytes of code to the keyboard-input subroutine. The code shown here as listing 1 should appear in the input

Listing 1: *Portion of Z80 code for uppercase to lowercase conversion, input section.*

Hexadecimal Object Code	Instruction Mnemonics	Comments
DB 30	XIN IN A,(30H)	;STATUS PORT
CB 4F	BIT 1,A	
28 FA	JR Z,XIN	
DB 31	IN A,(31H)	;KEYBOARD
CB BF	RES 7,A	;MASK PARITY

Listing 2: *Final portion of Z80 code for uppercase to lowercase conversion.*

Hexadecimal Object Code	Instruction Mnemonics
FE 61	CP 61H
F8	RET M
FE 7B	CP 7BH
F0	RET P
D6 20	SUB 20H
C9	RET



subroutine. The code in listing 2 goes at the end of the input subroutine, just before it returns to its calling routine.

Note that the uppercase option is completely under software control. The first compare-immediate (the CP 61H) instruction in listing 2 can be changed to a return (RET) instruction when lowercase is desired, and restored to CP when uppercase is desired. ■

Maintaining a Single Exit Point

Armond Inselberg, 234 Central Ave, Mountain View CA 94040

I agree with James Lewis, author of "Some Notes on Modular Assembly Programming" (December 1979 BYTE, page 222), in his emphasis on modular programming. However, another important tenet of structured programming is the use of a single entry point and a single exit point for a given program module.

The ABORT routine in the modular 8080 code example of listing 2 (on page 224) violates this principle of having only one exit point. In this case we find that the ABORT routine can be exited by either the JNZ (ie: jump if accumulator is not equal to 0) instruction or by the RET (return from subroutine) instruction.

To apply the single-exit principle to the ABORT routine, we must arrange things such that the RET instruction causes a return either to the monitor or to the main level of the application code. To return to the monitor using RET, we must replace the current return address on the stack with the entry-point address for the monitor.

The top of the stack can be changed with the XTHL instruction, which exchanges the contents of the H and L registers with the top of the stack. The ABORT routine would then be coded:

```
ABORT     LDA SHKEY
          ORA A
          JZ RETURN          ;no shift key request
          LXI H,MONITOR      ;shift key hit
          XTHL               ;exchange stack and HL
RETURN    RET
```

However, my preference is that the return to the monitor never be made at all from the ABORT routine, since ABORT is nested below the main level of code. I would rather proceed as follows.

First, in ABORT, test for the conditions requiring a monitor return, and set up the stack (if necessary) for the return to the monitor. Then, ABORT should set a signal requesting a return to the monitor, and then just return to the main level of the application code. At the main level, either a return to the monitor or a jump to the starting point of the application would be made.

The main level would then be coded:

```
START     CALL RANDOM
          CALL NOTE
          CALL ABORT
          JZ   START         ; no monitor request
          RET                ; monitor return requested.
```

■

SuperSoft announces a complete line of CP/M* compatible software

ACCOUNTING

SuperSoft offers a complete, interactive accounting system at an affordable price. We started with the Osborne accounting system, the standard of the industry, and made it even better. Since either the General Ledger and the Accounts Payable/Receivable can stand alone, you do not need to purchase the entire system at once. This means that you can start with what you need and up-grade later. Look for a compatible Payroll package in the future.

ACCOUNTS PAYABLE/RECEIVABLE: A complete, user oriented package which features:

automatic postings to general ledger (optional)

accounts payable: • check printing with invoice • invoice aging

accounts receivable: • progress billing • customer statements • partial invoice payments • invoice aging

The entire package is menu driven and easy to learn and use. It incorporates error checking and excellent user displays. This package can be used stand alone or with the General Ledger below. Requires: 48K CP/M, terminal with cursor positioning and clear screen, one 8" disk or Two 5" disks. CBASIC2 required.

Supplied with extensive user manual: $200.00. Manual alone: $20.00.

GENERAL LEDGER: A complete, user oriented package which features:

- Accepts postings from external programs (i.e. AP/AR above)
- Accepts directly entered postings
- Maintains account balances for current month, quarter, and year and previous three quarters
- Financial reports: trial balance, income statement balance sheet, and more.

Completely menu driven and easy to learn and use. Excellent displays and error checking for trouble free operation. Can be used stand alone or with Accounts Payable/Receivable above. Minimal requirements: 48K CP/M, terminal with cursor positioning, home and clear screen, one 8" disk or Two 5" disks. CBASIC2 required.

Supplied with extensive user manual: $200.00. Manual alone: $20.00.

TEXT PROCESSING

TFS—Text Formatting System: An extremely powerful formatter. More than 50 commands. Features include:

- left & right margin justification
- headers and footers
- page numbering
- chaptering
- dynamic insertion from disk file
- exdented & indented paragraphs
- works with any printer or CRT
- tabbing
- auto paragraphing
- auto list numbering
- centering
- user defined macros
- underlining and backspace
- much, much more

TFS lets you make multiple copies of any text. For example: Personalized form letters complete with name & address & other insertions from a disk file. Text is not limited to the size of RAM making TFS perfect for reports, manuals or any big job.

Text is entered using CP/M standard editor or most any CP/M compatible editor. TFS will link completely with Super-M-List making personalized form letters easy.

Requires: 24K CP/M.

Supplied with extensive user manual: $85.00. Manual alone: $20.00.

Source to TFS in 8080 assembler (can be assembled using standard CP/M assembler) plus user manual: $250.00.

MAILING LIST

SUPER-M-LIST: A complete, easy to use mailing list program package. Allows for two names, two address, city, state, zip and a three digit code field for added flexibility. Super-M-List can sort on any field and produce mailing labels direct to printer or disk file for later printing or use by other programs. Super-M-List is the perfect companion to TFS. Handles 1981 Zip Codes!

Requires: 24K CP/M.

Supplied with complete user manual: $75.00. Manual alone: $10.00

UTILITIES

Utility pack #1: A collection of programs that you will find useful and maybe even necessary in your daily work (we did!). Includes:

CMP: Compare two files for equality.
ARCHIVER: Compacts many files into one, useful when you run out of directory entries.
SORT: In core sort of variable length records.
XDIR: Extended, alphabetical directory listing with groupings by common extension.
PRINT: Formatted listings to printer.
PG: Lists files to CRT a page at a time.
... plus more ...

Requires: 24K CP/M.

Supplied with instructions on discette: $50.00.

SYSTEM MAINTENANCE

DIAGNOSTICS I: Easily the most comprehensive set of CP/M compatible system check-out programs ever assembled. Finds hardware errors in your system, confirms suspicions, or just gives your system a clean bill of health. Tests:

- Memory
- CPU (8080/8085/Z80)
- Terminal
- Disk
- Printer

To our knowledge the CPU test is the first of its kind anywhere. Diagnostics I can help you find problems before they become serious. A good set of diagnostic routines are a must in any program library.

Minimal requirements: 24K CP/M. Supplied with complete user manual: $50.00 Manual alone: $15.00.

SOFTWARE SECURITY

ENCODE/DECODE: A complete software security system for CP/M. Encode/Decode is a sophisticated coding program package which transforms data stored on disk into coded text which is completely unrecognizable. Encode/Decode supports multiple security levels and passwords. A user defined combination (One billion possible) is used to code and decode a file. Uses are unlimited. Below are a few examples:

- data bases
- payroll files
- programs
- general ledger
- correspondence
- tax records
- inventory
- accounts pay/rec
- mailing lists

Encode/Decode is available in two versions:

Encode/Decode I provides a level of security suitable for normal use. Encode/Decode II provides enhanced security for the most demanding needs. Both versions come supplied on discette and with a complete user manual.

Encode/Decode I: $50.00
Encode/Decode II: $100.00 Manual alone: $15.00

PROGRAMMING LANGUAGES

ENHANCED 'TINY' PASCAL: We still call it 'Tiny' but it's bigger and better than ever! This is the Famous Chung/Yuen 'Tiny' Pascal with more features added. Features include:

- recursive procedures/functions
- FOR (loop)
- IF ... THEN ... ELSE
- READ & WRITE
- integer arithmetic
- sequential disk I/O
- WHILE
- REPEAT ... UNTIL
- CASE
- one dimensional arrays
- 'PEAK' & 'POKE'
- more

'Tiny' Pascal is fast. Programs execute up to ten times faster than similar BASIC programs.

SOURCE TOO! We still distribute source, in 'Tiny' Pascal, on each discette sold. You can even recompile the compiler, add features or just gain insight into compiler construction.

'Tiny' Pascal is perfect for writing text processors, real time control systems, virtually any application which requires high speed. Requires: 36K CP/M. Supplied with complete user manual and source on discette: $85.00.

Manual alone: $10.00.

INTERCOMPUTER COMMUNICATIONS

TERM: a complete intercommunications package for linking your computer to other computers. Link either to other CP/M computers or to large timesharing systems. TERM is comparable to other systems but costs less, delivers more and source is provided on discette!

With TERM you can send and receive ASCII and Hex files (COM too, with included convertion program) with any other CP/M computer which has TERM or compatible package. Allows real time communication between users on separate systems as well as acting as timesharing terminal.

- Engage/disengage printer
- terminal mode for timesharing between systems
- send files
- error checking and auto retry
- conversational mode
- receive files

Requires: 32K CP/M.

Supplied with user manual and 8080 source code: $100.00

Manual alone: $15.00.

formats: CP/M 8" SOFT SECTORED, NORTHSTAR CP/M

All Orders and General Information:
SUPERSOFT ASSOCIATES
P.O. BOX 1628
CHAMPAIGN, IL 61820
(217) 344-7596
Technical Hot Line: (217) 384-0847
(answered only when technician is available)

VISA



SuperSoft
First in Software Technology

*CP/M REGISTERED TRADEMARK DIGITAL RESEARCH

Circle 94 on inquiry card.

H & E COMPUTRONICS INC.

•••EVERYTHING FOR YOUR TRS-80™•••

TRS-80 is a trademark of the Radio Shack Division of Tandy Corporation

★ *All Orders processed within 24-Hours*

★ *Free Shipping within U.P.S. areas (add $3 for orders outside of the U.S.A. or U.P.S. areas).*

★ *30-Day Money Back Guarantee on all Software (less a $3 penalty for handling).*

★ *10-Day Money Back Guarantee on Disk Drives and Printers* **PLUS** *120-Days Free Service.*

- **LEARNING LEVEL II** by David Lien
  The Original Author Of The Level Manual
  A Step By Step approach to Learning Level II especially geared to new TRS-80™ Owners
  $15.95

- **TRS-80 DISK AND OTHER MYSTERIES**
  $19.95 ($22.95 after 2/1/80). Over 100 pages of indespensible information for disk owners. Learn to recover information from bad disks, how to make Basic programs unlistable and 12 more chapters of never published tips and information. Written by H.C. Pennington (For all Disk Owners)

NEW SBSG BUSINESS SYSTEM FOR MODEL I OR MODEL II - IN STOCK
- General Ledger
- Accounts Receivable
- Accounts Payable
- Payroll
- Inventory Control With Invoicing

• Each module can be operated individually or as a coordinated **SYSTEM.** Turn-Key error catching operation for beginners
• Complete manual and documentation accompany each program
• Minimum System requirements 2-Disk Drives for Model I...1-Disk Drive for Model II
• Each module can be formatted to span data on Upto 4-Disk Drives
• Free 30-Day telephone consultation
• Call for complete specifications
• Model I Version $125 per module $495 per System
• Model II Version $225 per module $995 per System

DATA MANAGEMENT SYSTEMS
- DMS replace index cards or any data requiring long lists of information.
• TBS In-Memory Information System (for cassette systems) $24.50
• TBS Disk Data Manager (requires 1 or more disk drives)...Set up fast random access files in minutes. Stores up to 320K of information on 4 Drives. Up to 10 fields and 255 characters per record. Supports upper and lower case RS-232 or TRS-232... Features complete editing $49.50
• Personal Software CCA Data Management System...Completely user oriented, menu drive, 130 page Step by Step Manual... capable of inventory control, sorting data, reporting data in nearly any form (for reports and mailing labels). Sorts data by up to 10 fields for zip code, balance due, geographic location or whatever. Prints reports with subtotals and totals automatically calculated. Fast random access $75.00

FROM RACET COMPUTES
- **REMODEL-PROLOAD** - Renumbers program lines, combines programs. The only renumber program that will renumber the middle of a program. Specify 16K, 32K or 48K. Works with Cassette or Disk . . . **$34.95**
- **GSF** - Use in your Basic Programs for Instant Sorting (will sort 1000 items in 9 seconds). Other commands include Compress and Uncompress Data, Duplicate Memory, Display Screen Controls and Fast Graphic Controls . . . **$24.95** (For Cassette or Disk, specify 16K, 32K or 48K)
- **DOSORT** - All G.S.F. commands plus special Multiple Disk Sorting Routines . . . **$34.95** (Specify 32K or 48K)
- **INFINITE BASIC** - Adds 70 commands to your TRS-80 including Instant Sort, Matrix Commands, String Commands, Left and Right Justification, String Centering, Simultaneous Equations, Upper and Lower Case Reverse and more . . . **$49.95**. (For Cassette or Disk)
- **INFINITE BUSINESS** (Requires Infinite Basic) - Eliminate Round-off error, 127-Digit Calculation Accuracy, Insert New Elements in Sorted Arrays, Automatic Page Headings, Footings, and Pagination, Multiple Precision Arithmetic and more . . . **$29.95.** (For Cassette or Disk).
- **COPSYS** - Copy Machine Language Programs . . . **$14.95** (For Cassette only)

FROM SMALL SYSTEM SOFTWARE
- **RSM-2** Machine Language Monitor . . . **$26.95**
- **RSM-2D** Disk Version of RSM-2 . . . **$29.95**
- **DCV-1** Converts Machine Language Programs from tape to disk . . . **$9.95**
- **AIR RAID** - The ultimate TRS-80 game converts your TRS-80 into a real time shooting gallery . . . **$14.95**
- **BARRICADE** - A fast pong style game . . **$14.95**
- **CPM** - $150 (for Disk only)
- **TRS-232 INTERFACE** - Interface with Software driver RS-232 printers to your TRS-80 . . . **$49.95**
- **TRS-232 FORMATTER** - Additional (optional) Software for TRS-232 owners. Ads many printer commands to your TRS-80 . . . **$14.95** ($9.95 with purchase of TRS-232)

- **MAIL PAC** - For Model I or Model II Disk Systems only . . . **$99.95.** Quick-sorting full user control over mailing list from Gallactic Software.

FROM ADVENTURELAND INTERNATIONAL
- **ADVENTURE #1 - #8** by Scott Adams . **$14.95 each** . . . available on Cassette or Disk

SARGON II
THE CHESS CHAMP
$29.95

FROM APPARAT
NEW DOS + $99.95
35, 40 and 77 Track Versions available

FROM THE BOTTOM SHELF
- **CHECKBOOK II** (for Cassette or Disk) . . **$18.50**
- **INFORMATION SYSTEM** (for Cassette or Disk . . . **$24.50**
- **SYSTEM DOCTOR** (a complete diagnosis of your TRS-80 . checks memory, video, cassette, disk, ROM and all other parts of your system) - for Cassette or Disk . . . **$28.50**
- **CHECKBOOK REGISTER ACCOUNTING SYSTEM** (requires 2 disk drives) . . **$49.50**
- **LIBRARY 100** - 100 established business, game and educational programs plus **FREE** Tiny Pilot all for . . . **$49.50**
- **BASIC TOOL KIT** - lists all variables, GOTO's and GOSUB's in your program . . . **$19.80**

- **SOUNDWARE** - Ads sound to your TRS-80. Just plus it in . . .**$29.95.** Sample programs included.
- **TING TONG** - Can be used with Soundware for a **Sound** version of pong . . . **$9.95.**

- **VIC-The Carta Visual Instructional Computer Program** $19.95
  The **Level II** 16K Cassette is designed to teach beginners the Basics of Machine Language and Assembly Language Programming. See every Machine Language Instruction Display on your Video
  VIC includes a Step By Step 55 page manual

VISTA V80 DISK DRIVE
110 K OF STORAGE
$395
Add $29.95 for Cable
(Free with Purchase of Two Disk Drives).
— 10 Day Money Back Guarantee —

FROM HOWE SOFTWARE
MON-3 - Machine Language Programming for Beginners. **MON-3** is a Complete System Monitor with Users Manual . . . **$39.95**
MON-4 - Disk Version of **MON-3** . . . **$49.95**

LEVEL III BASIC . . . $49.95 FROM MICROSOFT - Now Cassette owners can add Disk Commands to their TRS-80 without owning a Disk Drive.

- **BRAND NEW OLIVETTI PRINTER . . .$2495**
  Business Letter quality print, Automatic Line Justification (on request), Quick Printing, can be used as a Memory Typewriter, plugs right into your TRS-80 without any modification or software

THE ELECTRIC PENCIL
Cassette . . . $99.95
Disk . . . $150.00

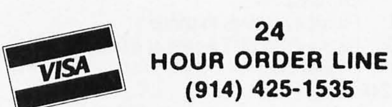
- **HORSE SELECTOR II** by Dr. Hal Davis . . . **$50.** The TRS-80 version updated for the TRS-80 and originally reviewed in Systems and Methods

H & E COMPUTRONICS INC.
MATHEMATICAL APPLICATIONS SERVICE™

Box 149 New City, New York 10956

48-Page Catalog $2 **FREE** *With Any Order*

Order by Phone or Mail
No Shipping Charge
Add $3 for C.O.D.
Add $3 for all Foreign and non-UPS shipments
Add $3 for UPS Blue Label



24
HOUR ORDER LINE
(914) 425-1535



Circle 75 on inquiry card.

Text continued from page 50:
address in the computer's memory from which the data was written onto the disk. All DTS numbers written on the disk have the bits that indicate the disk-drive number masked to 0 so that the file can be read from any disk drive, regardless of the drive in which it was loaded when it was written.

The *sector trailer* is 4 bytes long. The first 2 bytes contain the check sum. The last 2 bytes, except in the last sector in a file, contain the DTS number of the first sector of the file. In the last sector of the file, the last 2 bytes of the sector trailer contain the address at which execution of the contents of the file begins.

Software: The Basic Disk Routines

The basic disk routines handle head positioning, drive selection, sector selection, motor control, and computation of the check sum. Head positioning is performed by the use of the step and direction bits of the drive-select/status word (hexadecimal location CC03). Since the only indication of the position of the head is the track-0 bit in the drive-select/status word, the position of the head must be kept by software as a value in memory.

> KIMDOS is a KIM-1 compatible version of the Percom MINIDOS disk operating system.

In a multiple-drive disk system, it is desirable to keep track of the head positions of all drives in the system. The drive-selection routine (subroutine DRIV in listing 1) takes care of this. It saves the current track number of the current drive, restores the current track of the desired drive, and latches the desired drive into the controller. KIMDOS reinitializes the track registers (hexadecimal locations 000F thru 0013) with each operation so that preservation of these bytes is not necessary. However, if the system should be expanded with additional software, the track registers become very important. Inadvertant alteration of these locations would cause reading or writing of the wrong track.

In a multiple-drive system, drive motors are either all running or all stopped. The motors cannot be controlled individually since the drive-selection circuitry does not affect the motor-on signal. This necessitates some special handling of drive selection.

The drive-selection routine must insure that the write head is disabled before switching drives, or the area currently under the head of the newly selected drive will be overwritten. The drive-selection routine must also insure that the sector counter on the controller board is synchronized with the newly selected drive. This can be done only after at least one index pulse has been received from the new drive to reset the sector counter.

The sector-selection routine reads the sector number from the controller. It must catch the leading edge of the desired sector so that the read or write operation does not begin in the middle of the sector; it does this by looking for the change from the previous sector to the desired sector. The sector-selection routine detects the disk-missing condition by setting a KIM hardware timer located on one of the 6530 devices for a quarter of a second. If the timer times out before the desired sector is found, the routine assumes that the disk is not properly inserted in the drive.

Read and Write Routines

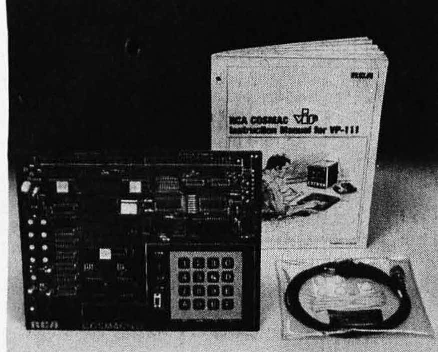
The read and write routines are a fundamental part of KIMDOS, which is given in listing 1. Listing 2 is a cross-reference table for the symbols used in listing 1.

The read routines are designed to automatically try again to read incorrectly read sectors. They will try to read a sector up to six times before reporting a read error. Intermittent errors (such as those caused by random electrical noise, airborne contaminants, slight fluctuations in motor speed, small defects in the written data or track surface, or any combination of the above) can be recovered by rereading the sector.

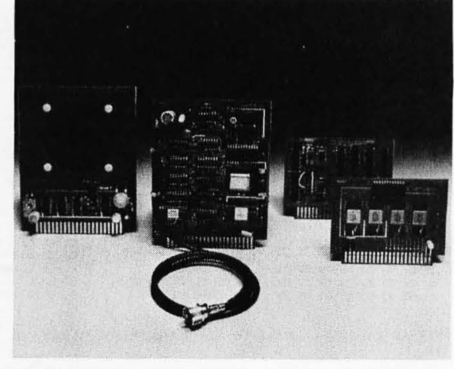
After a read error, the read routine acts as follows: first, the routine rereads twice. If that fails, the routine moves the head to track 0 and back in an attempt to clear any interfering

Text continued on page 178

The VIP hobby computer: Start programming for only $99.









New! VP 111 Microcomputer.... $99. Assembled* and tested.

Features:
- RCA 1802 Microprocessor.
- 1K Bytes static RAM.

Expandable on-board to 4K.
Expandable to 32K Bytes total.
- 512 Byte ROM operating system.
- CHIP-8 interpretive language or machine language programmable.
- Hexidecimal keypad.
- Audio tone generator.
- Single 5-volt operation.
- Video output to monitor or modulator.
- Cassette interface—100 Bytes/sec.
- Instruction Manual with 5 video game listings, schematics, CHIP-8, much more!

Ideal for low-cost control applications.

Expandable to full VIP capability with VP-114 Kit.

*User need only connect cables (included), a 5-volt power supply, and speaker.

New low price! The original VIP.. $199. Completely assembled and tested.

All the features of the VP-111 plus:
- A total of 2K Bytes static RAM.
- Power supply.
- 8 Bit input port.
- 8 Bit output port.
- I/O port connector.
- System expansion connector.
- Built-in speaker.
- Plastic cover.

Three comprehensive manuals:
- VIP Instruction Manual—20 video game listings, schematics, much more.
- VIP User's Guide—operating instructions and CHIP-8 for the beginner.
- RCA 1802 User's Manual (MPM-201B) - complete 1802 reference guide.



COSMAC VIP lets you add computer power a board at a time.

With easy-to-buy options, the versatile RCA COSMAC VIP means even more excitement. More challenges in graphics, games and control functions. For everyone, from youngster to serious hobbyist.

Built around an RCA COSMAC microprocessor, the VIP is easy to program and operate. Powerful CHIP-8 interpretive language gets you into programming the first evening. Complete documentation provided.

Send the coupon now...
Complete the coupon below and mail to: RCA VIP Customer Service, New Holland Avenue, Lancaster, PA 17604.

Or call toll free (800) 233-0094 to place your Master Charge or VISA credit card order. In Pennsylvania, call (717) 397-7661, extension 3179.

Please send me the RCA COSMAC VIP items indicated.

Type	Description	Price
☐ VP-111	New low cost Microcomputer (See description above)	$99
☐ VP-114	Expansion Kit for VP-111—Includes 3K RAM, I/O Port and connectors	$ 76
☐ VP-711	VIP—The original VIP Microcomputer (See description above)	$199
☐ VP-44	RAM On-Board Expansion Kit—Four 2114 RAM IC's. Expands VP 711 memory to 4K bytes	$ 36
☐ VP-590	VIP Color Board—Converts VIP to color. Four background and eight foreground colors	$ 69
☐ VP-595	VIP Simple Sound Board—Provides 256 programmable frequencies. For simple music or sound effects. Includes speaker	$ 30
☐ VP-550	VIP Super Sound Board—Turns your VIP into a music synthesizer! Two independent sound channels. On-board tempo control. Outputs to audio system	$ 49
☐ VP-570	VIP Memory Expansion Board—Plug-in 4K RAM memory	$ 95
☐ VP-580	VIP Auxiliary Keypad—Adds two-player interactive capability. 16-key keypad with cable. Connects to sockets on VP-590 or VP-585	$ 20
☐ VP-585	VIP Keypad Interface Board—Interfaces two VP-580 Auxiliary Keypads to VIP	$ 15
☐ VP-560	VIP EPROM Board—Interfaces two 2716 EPROMs to VIP	$ 34
☐ VP-565	VIP EPROM Programmer Board—Programs 2716 EPROMs. With software	$ 99
☐ VP-575	VIP Expansion Board—Provides 4 buffered and one unbuffered expansion sockets	$ 59
☐ VP-576	VIP Two-Board Expander—Allows use of 2 Accessory Boards in either I/O or Expansion Socket	$ 20
☐ VP-601	ASCII Keyboard—128-character ASCII Encoded alphanumeric keyboard	$ 69
☐ VP-611	ASCII/Numeric Keyboard—Same as VP-601 plus 16 key numeric keypad	$ 89
☐ VP-620	Cable: Connects ASCII keyboards to VIP	$ 20
☐ VP-700	VIP Tiny BASIC ROM Board—BASIC code stored in 4K of ROM	$ 39
☐ VP-710	VIP Game Manual—Listing for 16 exciting games	$ 10
☐ VP-720	VIP Game Manual-II—More exciting games (Available 2nd qtr. '80)	$ 10
☐ MPM-201B	CDP1802 User Manual—(Included with VP-711)	$ 5
☐	Please send more information	—

Enclosed is $________ for items checked plus shipping & handling charge of $3.00.
Add your state and local taxes $____________ Total enclosed $____________
I enclose ☐ check or ☐ money order or, charge my ☐ VISA/Bank Americard ☐ Master Charge.
Credit card account No.____________
Master Charge Interbank No. ____________Expiration date:________
Signature (required for credit card orders): ____________
Name (please type or print):____________
Street address: ____________ City:________
State & Zip: ____________ Telephone: (   )________
Make checks payable to RCA Corp. Prices and specifications are subject to change without notice.

Circle 96 on inquiry card.

Listing 1: *KIMDOS, a small disk-operating system for the KIM-1 microcomputer. KIMDOS is a set of disk read and write routines used with a KIM-1 connected to a Percom LFD-400 floppy-disk system. KIMDOS occupies under 1 K bytes of memory (from hexadecimal addresses C000 thru C3FE) and can be stored in one 2708 erasable programmable read-only memory (EPROM). Observe that this listing does not use standard 6502 mnemonics.*

Line Number | **Hexadecimal Address** | **Object Code** | **Label** | **Instruction Mnemonic** | **Operand** | **Commentary**

```
                    KIMDOS  -  MINI DOS FOR KIM

                    VERSION 3  SEPTEMBER 1979

                    ZERO PAGE STORAGE

                    01 - 0A IS THE SECTOR HEADER

C000              KIMDOS ORG   $C000

C000              DSDR   *     $0000    DESIRED DRIVE
C000              DSTK   *     $0001    AND DESIRED TRACK
C000              DSEC   *     $0002    DESIRED SECTOR
C000              BLTK   *     $0003    BACK LINK TRACK #
C000              BLSC   *     $0004    BACK LINK SECTOR #
C000              FLTK   *     $0005    FORWARD LINK TRACK #
C000              FLSC   *     $0006    FORWARD LINK SECTOR #
C000              LEN    *     $0007    BYTE COUNT (RECORD LENGTH)
C000              TGTP   *     $0008    TARGET ADDRESS
C000              TGTL   *     $0008
C000              TGTH   *     $0009
C000              FTYP   *     $000A    FILE TYPE

                    0B - 0E IS THE SECTOR TRAILER

C000              CKSL   *     $000B    THE CHECKSUM
C000              CKSH   *     $000C
C000              PSTL   *     $000D    POSTAMBLE/EXECUTION ADDRESS
C000              PSTH   *     $000E
C000              CRTK   *     $000F    CURRENT TRACK
                    CURRENT TRACK SAVEAREA
C000              CTKP   *     $0010    DRIVE 0
C000              CTKQ   *     $0011    DRIVE 1
C000              CTKR   *     $0012    DRIVE 2
C000              CTKS   *     $0013    DRIVE 3

C000              DPTR   *     $0014    DATA POINTER
C000              DPTL   *     $0014
C000              DPTH   *     $0015
C000              ALTP   *     $0016    ALTERNATE LOAD POINTER
C000              ALTL   *     $0016
C000              ALTH   *     $0017
C000              TPXH   *     $0018    CKSUM TEMP STORAGE
C000              EXCL   *     $0019    PROGRAM EXECUTION ADDRESS
C000              EXCH   *     $001A
C000              SAVEP  *     $001B
C000              CRDR   *     $001B    CURRENT DRIVE TEMPORARY
C000              HIOR   *     $001B    TEMPORARY STORAGE FOR CDTS
C000              RCNT   *     $001B    READ COUNT TEMPORARY
C000              CKPT   *     $001C    CKSUM POINTER
C000              CKPL   *     $001C
C000              CKPH   *     $001D
C000              DTSA   *     $001C    DRIVE TRACK SAVE
C000              TSSA   *     $001D    TRACK SECTOR SAVE
C000              ENDL   *     $001E    END OF DATA
C000              ENDH   *     $001F

C000              PCL    *     $00EF    PROGRAM COUNTER SAVE
C000              PCH    *     $00F0
C000              PNTL   *     $00FA    DISPLAY WINDOW
C000              PNTH   *     $00FB

                    CONTROLLER COMMUNICATION ADDRESSES

                    INPUT
C000              RDST   *     $CC00    USRT STATUS
C000              RDTA   *     $CC01    RECEIVE DATA
C000              SECT   *     $CC02    SECTOR COUNTER
C000              DVST   *     $CC03    DRIVE STATUS
C000              RRST   *     $CC04    RECEIVER RESTART PULSE
C000              MON    *     $CC05    MOTOR ON PULSE (SEND)
C000              MOFF   *     $CC06    MOTOR OFF PULSE (SEND)

                    OUTPUT
C000              SYNC   *     $CC00    SYNC WORD
C000              WDTA   *     $CC01    SEND DATA
C000              FILL   *     $CC02    FILL WORD
C000              DTSL   *     $CC03    DRIVE SELECT
C000              WPLS   *     $CC04    WRITE PULSE

                    OTHER LABELS

C000              TJX    *     $1705    TIMER START
C000              TOUT   *     $1707    TIME OUT CHECK
C000              STRT   *     $1C4F


                    EQUATES

C000              WRTBIT *     $0008
C000              MTRBIT *     $0004
C000              MILSEC *     $007D
C000              ZERO   *     $0000
C000              DRVMSK *     $00CF
C000              STEPIN *     $0010
C000              SCTMSK *     $000F
C000              HEDLEN *     $000A
C000              TRKMSK *     $003F
C000              TRKLMT *     $0023
C000              SCTBIT *     $0010
C000              STPBIT *     $0020


                    ERROR CODES

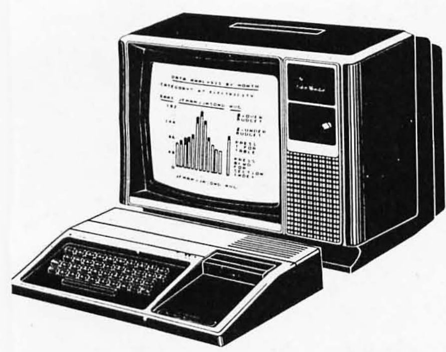
C000              DISKMS *     $0000    DISK MISSING
C000              WPROT  *     $0001    WRITE PROTECT
C000              INVSEC *     $0002    INVALID SECTOR #
```

Listing 1 continued on page 162

Fantastic Introductory Savings!

TEXAS INSTRUMENTS
INCORPORATED

TI-99/4
home computer



You can begin using the TI Home Computer in minutes — Without any previous computer experience. You simply snap in one of TI's Solid State Software™ Command Modules. Step-by-step instructions are displayed right on the screen.

Solid State Software Command Modules come in a wide range of application areas — from education to entertainment to personal finance and home management.

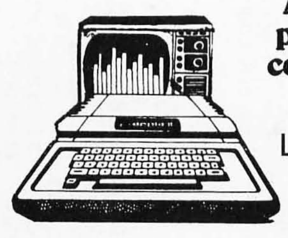
FEATURES:

- Powerful TI-BASIC
- Up to 72K total memory capacity
- Outstanding graphic, music and sound capabilities
- 13" color monitor included
- Revolutionary Solid State Speech™ Synthesizer is optional

List $1150

OUR PRICE $995





Apple II personal computer.

16K
List $1195
ONLY
$989

32K, List $1395 **$1169**
48K, List **$1259**

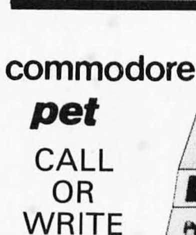


SORCERER COMPUTER

16K RAM, expandable to 48K. List $1295.

OUR PRICE ONLY $999

32K Model, List $1395	**$1099**
48K Model, List $1495	**$1199**
Video Display, List $499	**$439**
Display Disk, List $2995	**$2599**
Floppy Disk Subsystem, List $1150	**$999**
S-100 Expansion Unit, List $419	**ONLY $369**
Software	
Development PAC™, List $99	**$ 89**
Word Processing PAC™, List $199	**$179**
EPROM PAC™, List $49	**$ 45**
Microsoft Disk-Extended BASIC, $300	**$259**



commodore
pet

CALL OR WRITE FOR PRICES!





A Warner Communications Company

ATARI® 400™ PERSONAL COMPUTER SYSTEM

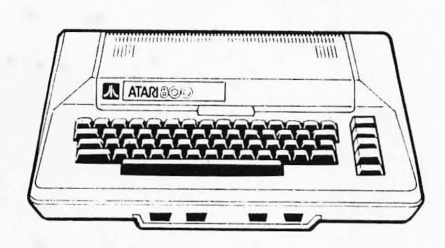


List $630 **ONLY $499**

ATARI® 800™ PERSONAL COMPUTER SYSTEM.

List $1080

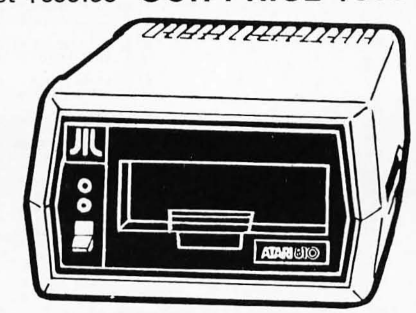
ONLY $849



ATARI® 820™ Printer, List $599.95		**$499**
CX852 8K RAM Memory Module	List $124.95	**$105**
CX853 16K RAM Memory Module	List $199.95	**$169**
CX30-04 Paddle Controller	**Pair**	**$19.95**
CX40-04 Joystick Controller	**Pair**	**$19.95**

ATARI® 810 DISC DRIVE

List $699.95 **OUR PRICE $589**



Immediate delivery on most items. Prices do not include shipping by UPS. Prices and offers subject to change without notice.

Personal Computer Systems





609 Butternut St.,
Syracuse, NY 13208
(315) 478-6800

Circle 97 on inquiry card.

Listing 1 continued:

```
C000             BLNKSC *   $0003     BLANK SECTOR
C000             OVRUN  *   $0004     DISK OVERRUN
C000             READER *   $0005     PERMINENT READ ERROR

                  SECTION 1 THE BASIC ROUTINES


                  JUMP TABLE

C000 4C AA C1           JMP    RSEX   READ SECTOR
C003 4C CF C2           JMP    WSEX   WRITE SECTOR
C006 4C 7E C2           JMP    SAVX
C009 4C 89 C1           JMP    LODX
C00C 4C DA C0           JMP    PREP
C00F 4C B8 C3           JMP    CVTBIN
C012 4C 90 C3           JMP    CVTDEC
C015 4C 4C C3           JMP    FWDC

                  INITDV : INITIALIZE THE TRACK REGISTERS

C018 A9 FF       INITDV LDAIM $FF     OFFLINE CODE
C01A A2 04              LDXIM $04     5 TRACK REGISTERS
C01C 95 0F       INTLUP STAZX CRTK    INIT  A REGISTER
C01E CA                 DEX           COUNT
C01F 10 FB              BPL   INTLUP  NEXT
C021 60                 RTS

                  GTKX : MOVE HEAD TO TRACK 0

C022 20 40 C0    GTKX   JSR    TKIN   MOVE IN
C025 20 40 C0           JSR    TKIN
C028 20 38 C0    GETP   JSR    TKOT   MOVE OUT
C02B AD 03 CC           LDA    DVST   TRACK 0?
C02E 4A                 LSRA
C02F 4A                 LSRA
C030 B0 F6              BCS    GETP   NO
C032 A9 00              LDAIM  $00    ZERO CURENT TRACK
C034 85 0F              STAZ   CRTK
C036 F0 47              BEQ    SETL   UNCONDITIONAL BRANCH

                  TKIN , TKOT : MOVE HEAD IN OR OUT 1 TRACK

C038 AD 03 CC    TKOT   LDA    DVST   GET DRIVE# IN 2 MSB
C03B 29 CF              ANDIM  DRVMSK
C03D 4C 47 C0           JMP    MTVR
C040 AD 03 CC    TKIN   LDA    DVST
C043 29 CF              ANDIM  DRVMSK
C045 09 10              ORAIM  STEPIN STEP IN BIT
C047 8D 03 CC    MTVR   STA    DTSL   SET DIRECTION
C04A 20 83 C0           JSR    DEL
C04D 09 20              ORAIM  STPBIT SET STEP BIT
C04F 8D 03 CC           STA    DTSL
C052 EA                 NOP
C053 EA                 NOP           STRETCH PULSE WIDTH
C054 EA                 NOP
C055 29 DF              ANDIM  $DF    RESET STEP BIT
C057 8D 03 CC           STA    DTSL
C05A AD 05 CC           LDA    MON    RETRIGGER MOTOR
C05D 4C 83 C0           JMP    DEL


                  SEEX : MOVE HEAD TO DESIRED TRACK

C060 A5 01       SEEX   LDAZ   DSTK   GET DESIRED TRACK#
C062 29 3F              ANDIM  TRKMSK IGNORE DRIVE#
C064 A8                 TAY
C065 C4 0F              CPYZ   CRTK   THERE ALREADY?
C067 F0 2B              BEQ    SOUT   YES
C069 90 0B              BCC    STPO   LESS THAN CURRENT
C06B 20 40 C0    STPI   JSR    TKIN   STEP IN
C06E E6 0F              INCZ   CRTK
C070 C4 0F              CPYZ   CRTK   THERE YET?
C072 D0 F7              BNE    STPI   NO
C074 F0 09              BEQ    SETL
C076 20 38 C0    STPO   JSR    TKOT   STEP OUT
C079 C6 0F              DECZ   CRTK
C07B C4 0F              CPYZ   CRTK   THERE YET?
C07D D0 F7              BNE    STPO   NO
C07F A2 1E       SETL   LDXIM  $1E    30 MS HEAD SETTLING
C081 D0 02              BNE    DELA

                  DELAY 20 MS
C083 A2 14       DEL    LDXIM  $14

                  DELA : DELAY 1 MILISEC FOR EACH INC OF X

C085 48          DELA   PHA
C086 A9 7D       LUUP   LDAIM  MILSEC
C088 8D 05 17           STA    TJX    START TIMER
C08B AD 07 17    LOOP   LDA    TOUT   TIME UP?
C08E F0 FB              BEQ    LOOP   NO
C090 CA                 DEX
C091 D0 F3              BNE    LUUP   1 MS PER LOOP
C093 68                 PLA
C094 60          SOUT   RTS

                  DRVTST : SYNC SECTOR COUNTER TO CURRENT DRIVE

C095 20 31 C1    DRVTST JSR    START  MOTOR
C098 A0 19              LDYIM  $19    25 CHANGES
C09A 20 80 C1           JSR    FFTIME SET TIMER
C09D A9 10       DVLUP  LDAIM  SCTBIT
C09F 2D 03 CC           AND    DVST   GET SECTOR BIT
C0A2 AE 07 17           LDX    TOUT   TIME UP?
C0A5 D0 0F              BNE    ERRJ   YEP
C0A7 AA                 TAX
C0A8 45 1B              EORZ   SAVEP  CHANGE IN SECTOR BIT?
C0AA F0 F1              BEQ    DVLUP  NO, WAIT
C0AC 86 1B              STX    SAVEP  YES SAVE AND COUNT
C0AE 88                 DEY
C0AF D0 EC              BNE    DVLUP
C0B1 AD 05 CC    RETRIG LDA    MON    RETRIGGER MOTOR
C0B4 18                 CLC
C0B5 60                 RTS
C0B6 A9 00       ERRJ   LDAIM  DISKMS DISK MISSING
C0B8 38                 SEC
C0B9 60                 RTS


                  PREP : SELECT AND PREPARE DRIVE FOR OPERATION

C0DA A5 02       PREP   LDA    DSEC   GET SECTOR
```

```
C0BC CD 0A 0A          CMP    $0A     LESS THAN 10?
C0BF B0 0C             BCS    BADPRM  NO , ERROR
C0C1 A5 01             LDA    PSTK    GET TRACK
C0C3 29 3F             ANDIM  TRKMSK  CLEAR DRIVE
C0C5 C9 23             CMPIM  TRKLMT  OVERFLOW?
C0C7 90 07             BCC    DRIV    NO, GO CHECK DRIVE
C0C9 A9 04    OVFL     LDAIM  OVRUN   YES, ERROR 4
C0CB 38                SEC
C0CC 60                RTS
C0CD A9 02    BADPRM   LDAIM  INVSEC   INVALID SECTOR
C0CF 60                RTS

C0D0 AD 03 CC DRIV     LDA    DVST    GET CURRENT DRIVE
C0D3 29 C0             ANDIM  $C0
C0D5 85 1B             STAZ   CRDR    SAVE
C0D7 A5 00             LDAZ   DSDR    GET DESIRED DRIVE
C0D9 29 C0             ANDIM  $C0
C0DB C5 1B             CMPZ   CRDR    SAME?
C0DD D0 08             BNE    SWIT    NO , SWITCH DRIVES
C0DF A5 0F             LDA    CRTK    GET CURRENT TRK
C0E1 C9 FF             CMPIM  $FF     DRIVE INITIALIZED?
C0E3 F0 24             BEQ    DI      NO
C0E5 D0 30             BNE    DS      YES

C0E7 48       SWIT     PHA
C0E8 A5 1B             LDAZ   CRDR
C0EA 18                CLC
C0EB 2A                ROLA
C0EC 2A                ROLA            ROL DRIVE# TO 2 LSB
C0ED 2A                ROLA
C0EE AA                TAX
C0EF A5 0F             LDAZ   CRTK    SAVE CURRENT TRACK
C0F1 95 10             STAZX  CTKP    IN SAVEAREA
C0F3 68                PLA
C0F4 48                PHA
C0F5 18                CLC
C0F6 2A                ROLA
C0F7 2A                ROLA
C0F8 2A                ROLA
C0F9 AA                TAX
C0FA B5 10             LDAZX  CTKP    GET CURRENT TRACK
C0FC 85 0F             STAZ   CRTK    FROM SAVEAREA
C0FE A9 08    DA       LDAIM  WRTBIT
C100 2C 03 CC DB       BIT    DVST    IS WRITE GATE OFF?
C103 F0 FB             BEQ    DB      NO , THEN WAIT
C105 68                PLA

C106 8D 03 CC          STA    DTSL    NOW SELECT DRIVE
C109 20 95 C0 DI       JSR    DRVTST  SYNC TO DRIVE
C10C B0 10             BCS    DP      ERROR EXIT
C10E A5 0F             LDA    CRTK
C110 C9 FF             CMPIM  $FF     DRIVE ONLINE?
C112 D0 03             BNE    DS      YES
C114 20 22 C0          JSR    CTKX    NO , ZERO TRACK
C117 20 31 C1 DS       JSR    START   CHECK MOTOR
C11A 20 60 C0          JSR    SEEX    FIND DESIRED TRACK
C11D 18                CLC
C11E 60       DP       RTS

                CKSEC : PART OF CTSC

C11F AD 07 17 CKSEC    LDA    TOUT    TIME UP?
C122 D0 08             BNE    MISS    YEP
C124 AD 02 CC          LDA    SECT    GET CURRENT SECTOR
C127 29 0F             ANDIM  SCTMSK
C129 C5 02             CMP    DSEC    = DESIRED?
C12B 60                RTS
C12C 68       MISS     PLA            RESTORE STACK
C12D 68                PLA
C12E 4C B6 C0          JMP    ERRJ

                START : START MOTOR

C131 A9 04    START    LDAIM  MTRBIT
C133 2C 03 CC          BIT    DVST    IS MOTOR ON?
C136 F0 0C             BEQ    STARTR  YES
C138 A8                TAY
C139 AD 05 CC          LDA    MON     START IT
C13C A2 00             LDXIM  ZERO
C13E 20 85 C0 DELSS    JSR    DELA    THEN WAIT ASEC
C141 88                DEY
C142 D0 FA             BNE    DELSS
C144 4C B1 C0 STARTR   JMP    RETRIG

                CTSC : WAIT FOR DESIRED SECTOR TO COME AROUND

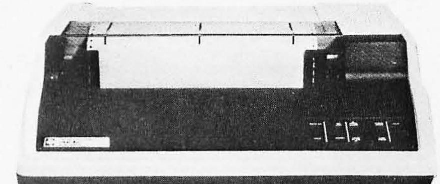
C147 78       CTSC     SEI            DISABLE INTERRUPTS
C148 20 80 C1          JSR    FFTIME  START TIMER
C14B 20 1F C1 CTLUPA   JSR    CKSEC   IF DESIRED IS CURRENT
C14E F0 FB             BEQ    CTLUPA  THEN WAIT TILL NXT REV
C150 20 1F C1 CTLUPB   JSR    CKSEC   THEN WAIT FOR
C153 D0 FB             BNE    CTLUPB  DESIRED
C155 18                CLC
C156 60                RTS


                CRC : COMPUTE CHECKSUM FROM DATA & HEADER

C157 A5 14    CRC      LDA    DPTL    MOVE DATA PTR
C159 85 1C             STA    CKPL    TO CKSUM PTR
C15B A5 15             LDA    DPTH
C15D 85 1D             STA    CKPH
C15F A6 07             LDXZ   LEN     GET LENGTH
C161 A9 00             LDAIM  ZERO    CLEAR SUM
C163 A8                TAY
C164 85 18             STAZ   TPXH    CLEAR TEMP STORAGE
C166 20 72 C1          JSR    CX      COMPUTE DATA SUM
C169 86 1D             STXZ   CKPH    POINT TO HEADER
C16B E8                INX
C16C 86 1C             STXZ   CKPL
C16E A2 0A             LDXIM  HEDLEN  HEADER LENGTH
C170 A0 00             LDYIM  ZERO
C172 51 1C    CX       EORIY  CKPT    COMPUTE CKSUM
C174 0A                ASLA
C175 26 18             ROLZ   TPXH
C177 90 02             BCC    CQ
C179 69 00             ADCIM  ZERO
C17B C8       CQ       INY
C17C CA                DEX
C17D D0 F3             BNE    CX
C17F 60                RTS
```

Listing 1 continued on page 166

T.I. 810 Printer



Bi-directional; 150 cps; logic seeking; adjustable tractor. Available with lower case compressed print; Forms Length Control or Vertical Forms Control option.

TI-810 Basic Unit, List $1895 **ONLY $1695**
TI-810 w/full ASCII (lower case), vertical forms control, and compressed print . **$1895**
TI-825 75 cps, w/lower case, List $1565 . . . . **$1395**

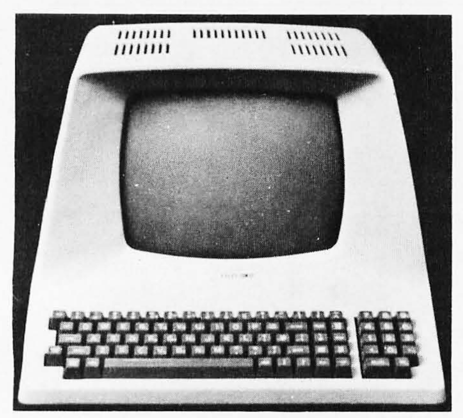
NEC Spinwriter™



5510 or 5530 Centronics parallel interface w/Tractor, List $3285 . . . . ONLY $2889
5510 or 5530 w/o Tractor, List $3265 . . . $2689

Call us for Centronics, Integral Data, Paper Tiger, Anadex, Okidata, et.al.

Televideo TVI-912



OUR PRICE ONLY **$789**

Upper case and lower case; 15 baud rates: 75 to 19,000 baud; dual intensity; 24 x 80-char. display, 12 x 10 resolution. Numeric pad. Programmable reversible video; aux. port; self-test mode; protect mode; block mode; tabbing; addressable cursor. Microprocessor controlled; programmable underline; line and character insert/delete.

Bantam 550



PERKIN ELMER

NOW FROM US AT

$799

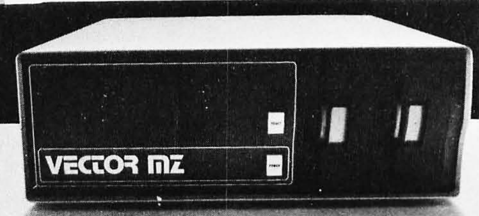
with anti-glare CRT only $829

$10,000 Value!

Complete Business System only $5995

(Price includes air freight shipping)





VECTOR SYSTEM B, complete with Vector Mindless Terminal, 64K of RAM, Dual Floppy Disks (630 kilobytes of storage), and printer . . . so complete, you'll get all cables, box of 10 Floppy Disks, and EVEN a box of 3500 sheets of Fanfold Paper.

OVER $3500 OF SOFTWARE INCLUDED!!!

Digital Research's 2.0 CP/M™ Disk Operating System, Interpreter, Microsoft 80 BASIC



AND one of the finest Business Packages — from Retail Science's PEACHTREE SOFTWARE:

- GENERAL LEDGER
- ACCOUNTS RECEIVABLE
- ACCOUNTS PAYABLE
- INVENTORY
- PAYROLL

The System B doubles as an EXCELLENT Word Processing System (Software at slight additional cost).

System may be expanded for multi-user time-sharing data and word processing! Up to 5 terminals at nominal cost.

Unless otherwise specified, shipping charges are additional. All prices subject to change and all offers subject to withdrawal without notice. Prices in this ad are for prepaid orders. Slightly higher prices prevail for other-than-prepaid orders, i.e., C.O.D., credit card, etc.



— WRITE FOR FREE CATALOG —

MiniMicroMart

1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

MiniMicroMart:

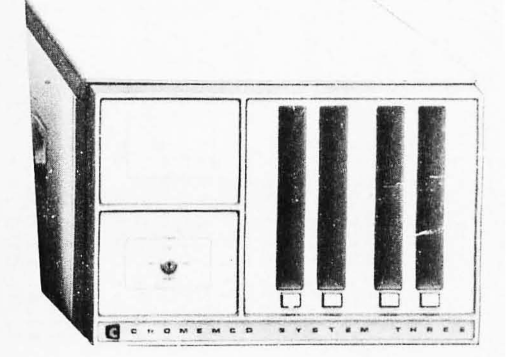
Your No. 1 Supplier of Systems for Business Applications and Word Processing . . .



HARD DISKS

MiniMicroMart is your best source for Hard Disk Systems!

Cromemco, North Star, Vector, Dynabyte, Morrow Thinker Toys® Corvis, Lobo, et. al.



North Star Horizon® 2

32K 4 MHz, dual-drive, with double density controller board, two RS232C serial ports, a parallel port. Included is DOS and North Star Extended Disk BASIC.

Horizon 2, 32K, DD, List $3095 ONLY $2619

32K, Quad Density, List $3595 $3049

64K, Double Density ($3830) $3239

64K Quad System also available.

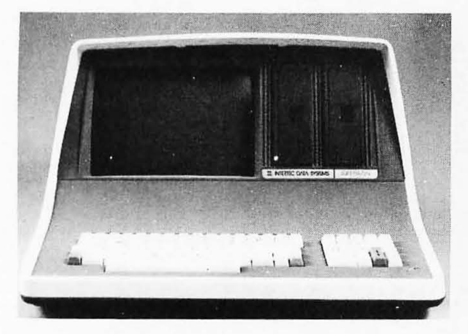
Cromemco System 3

Features 4 MHz CPU, 64K of RAM, dual-sided Per-Sci 299B Floppy Disk Drive, RS232C interface, and printer interface.

Cromemco System 3, List $6990 ONLY $5890

System 2, List $3990 OUR PRICE $3390

Z-2H Hard Disk Computer System, List $9995 $8489



SUPERBRAIN™

32K or 64K totally self-contained computer, uses two Z-80 CPU's. Commercial-type terminal with 12" monitor (like the Intertube). Dual double density minifloppies (quad density available). Comes with CP/M™ operating system; BASIC included.

32K, List $2995 ONLY $2685

SuperBrain, 64K OUR PRICE $2883

Circle 98 on inquiry card.

Complete your system with a Terminal, Printer, Business Software:

INCLUDES:

- Your choice of Terminal
  - P-E Bantam 500
  - Intertube II
  - Televideo 912
  - SOROC 120
- 10 Floppy Disks
- Two RS232 Cables
- Software with Manuals
  - General Ledger
  - Accounts Receivable
  - Accounts Payable
  - Payroll
- 3500 Sheets of Paper
- Anadex DP-8000 Printer

Over $2500 Value . . .*Limited Time Special $1795*

With T.I. 810 Printer — Retail Value over $3400 . . **ONLY $2595**

When purchased with SuperBrain (Terminal not required or furnished)

With Anadex DP-8000 Printer **$1049**

With T.I. 810 Printer **$1695**

— THIS OFFER EXPIRES JULY 10, 1980 —

Listing 1 continued:

```
                             FFTIME : START TIMER FOR 1/4 SECOND.
                                      STORE TWICE FOR 6530 BUG.

C180 A9 FF        FFTIME LDAIM $FF
C182 8D 07 17     STIMER STA   TOUT
C185 8D 07 17            STA   TOUT
C188 60                  RTS



                             SECTION 2 READ ROUTINES



                             LODX : READ A MEMORY FILE FROM DISK

C189 20 AA C1     LODX   JSR   RSEX   READ A SECTOR
C18C B0 38               BCS   RDRT   PERMINENT ERROR
C18E A5 06               LDAZ  FLSC
C190 D0 06               BNE   NEND   CHECK FOR LAST SECTOR
C192 A5 05               LDAZ  FLTK   (FORWARD LINK ZERO)
C194 F0 0B               BEQ   COPPL  END
C196 A5 06               LDAZ  FLSC
C198 85 02        NEND   STAZ  DSEC   COPY FORWARD LINK TO
C19A A5 05               LDAZ  FLTK   DESIRED TRACK/SECTOR
C19C 85 01               STAZ  DSTK
C19E 4C 89 C1            JMP   LODX   READ NEXT SECTOR
C1A1 A5 0D        COPPL  LDA   PSTL   COPY EXEC ADDRESS
C1A3 85 EF               STA   PCL    TO KIM'S PC
C1A5 A5 0E               LDA   PSTH
C1A7 85 F0               STA   PCH
C1A9 60                  RTS

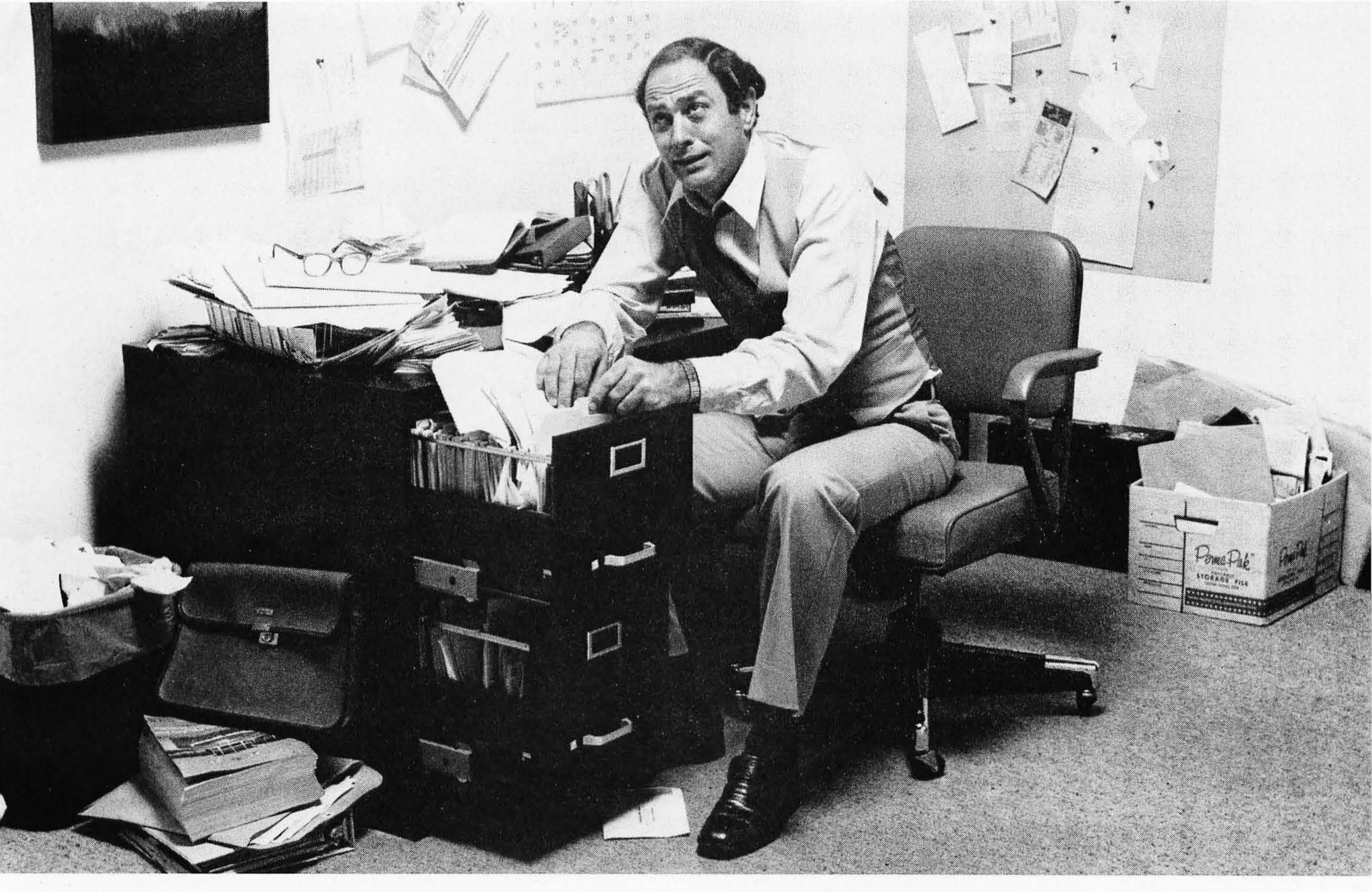
                             RSEX : READ A SECTOR WITH ERROR RETRY

C1AA 20 BA C0     RSEX   JSR   PREP   PEPARE DRIV
C1AD B0 17               BCS   RDRT   ERROR EXIT
C1AF 20 C7 C1            JSR   RDS    TRY UP TO 3 TIMES
C1B2 B0 12               BCS   RDRT   ERROR CODE IN A
C1B4 D0 10               BNE   RDRT   SUCCESS
C1B6 20 22 C0            JSR   CTKX
C1B9 20 60 C0            JSR   SEEX   RE-SEEK TRACK
C1BC 20 C7 C1            JSR   RDS    TRY AGAIN
C1BF B0 05               BCS   RDRT
C1C1 D0 03               BNE   RDRT
C1C3 A9 05               LDAIM HEADER READ ERROR
C1C5 38                  SEC
C1C6 60           RDRT   RTS

                             RDS : READ A SECTOR WITH 2 RETRYS

C1C7 A9 03        RDS    LDAIM $03    3 TRYS
C1C9 85 1D               STAZ  RCNT
C1CB A9 FB        READ   LDAIM $FB    SYNC CHAR
C1CD 8D 00 CC            STA   SYNC
C1D0 08                  PHP           SAVE INTERRUPT
C1D1 20 47 C1            JSR   CTSC   FIND SECTOR
C1D4 B0 0D               BCS   NOSEC
C1D6 A2 1E               LDXIM $1E    SHORT DELAY TO
C1D8 CA           RQ     DEX           PASS OVER SECTOR BOUNDARY
C1D9 D0 FD               BNE   RQ
C1DB AD 04 CC            LDA   RRST   START RECIEVER
C1DE 20 66 C2            JSR   IN     SKIP SYNC
C1E1 90 03               BCC   ROK    SYNC FOUND
C1E3 28           NOSEC  PLP           RESTORE INTERRUPTS
C1E4 38                  SEC
C1E5 60                  RTS
C1E6 20 66 C2     ROK    JSR   IN     GET TRACK
C1E9 A8                  TAY
C1EA 45 01               EORZ  DSTK   CHECK FOR PROPER TRACK
C1EC 29 3F               ANDIM TRKMSK IGNORE DRIVE
C1EE D0 56               BNE   SKER   SEEK ERR
C1F0 98                  TYA
C1F1 85 01               STAZ  DSTK
C1F3 20 66 C2            JSR   IN     GET SECTOR
C1F6 C5 02               CMPZ  DSEC   PROPER SECTOR?
C1F8 D0 4C               BNE   SKER   NO
C1FA A2 00               LDXIM ZERO
C1FC 20 66 C2     HLUP   JSR   IN     GET REST OF HEADER
C1FF 95 03               STAZX BLTK
C201 E8                  INX
C202 E0 08               CPXIM $08
C204 D0 F6               BNE   HLUP
                         PREPARE FOR READING DATA
                         DETERMINE WHICH ADDRESS TO USE
C206 A5 17               LDAZ  ALTH
C208 F0 09               BEQ   NOAL
C20A 85 15               STAZ  DPTH   USE ALT IF NON-ZERO
C20C A5 16               LDAZ  ALTL
C20E 85 14               STAZ  DPTL
C210 4C 1B C2            JMP   GDAT
C213 A5 08        NOAL   LDAZ  TGTL   ELSE USE ADDRESS IN HEADER
C215 85 14               STAZ  DPTL
C217 A5 09               LDAZ  TGTH
C219 85 15               STAZ  DPTH
C21B A0 00        GDAT   LDYIM ZERO
C21D AD 00 CC     DALP   LDA   RDST   DATA READY?
C220 4A                  LSRA
C221 90 FA               BCC   DALP   NO
C223 AD 01 CC            LDA   RDTA
C226 91 14               STAIY DPTR   SAVE A BYTE
C228 C8                  INY
C229 C4 07               CPYZ  LEN
C22B D0 F0               BNE   DALP   READ UNTIL COUNT EXPIRES
C22D A2 00               LDXIM $00
C22F 20 66 C2     CLUP   JSR   IN     GET CHECKSUM
C232 95 0B               STAZX CKSL   AND POSTAMBLE
C234 E8                  INX
C235 E0 04               CPXIM $04
C237 D0 F6               BNE   CLUP
C239 20 57 C1            JSR   CRC    COMPUTE CHECKSUM
C23C C5 0B               CMPZ  CKSL   COMPARE WITH ONE READ
C23E D0 06               BNE   SKER
C240 A5 18               LDAZ  TPXH
C242 C5 0C               CMPZ  CKSH
C244 F0 0A               BEQ   SUCC
C246 28           SKER   PLP
C247 C6 1D               DECZ  RCNT   COUNT TRYS
C249 F0 03               BEQ   SERR
C24B 4C CB C1            JMP   READ
```

Listing 1 continued on page 168



Record keeping problems? Our CCA Data Management System solves them easily.

Having information at your fingertips can make your job a whole lot easier. And that's what the CCA Data Management System is all about.

With this Personal Software™ package and an Apple II™ or TRS-80™ disk system, it will be far easier to keep inventories, customer lists, accounts receivable and payable records, patient histories and many more items.

In fact, you can use the CCA DMS for all of your data management needs, rather than buying (expensive) or writing (time consuming) separate programs for each application. That's because DMS lets you create your own filing systems, adapting itself to the types of records you keep. You specify the number and names of each data field—without any programming.

With DMS keeping all of your records, you only have to learn how to use one system. That's easier, too. It's menu driven, with plenty of prompts to help you create files and add, update, scan, inspect, delete, sort, condense and print data. Our comprehensive 130-page step-by-step instruction manual even provides complete "how to" inventory and mailing list applications so you can start processing immediately.

DMS is a very powerful system, with more file and record storage capacity than other data base programs on the market.

And it also gives you greater data handling flexibility. To customize DMS, write add-on BASIC programs that read or write DMS files and perform any kind of processing you want.

You can sort and print your data in nearly any form of report and mailing label you want. Sort data by up to 10 fields for zip code, balance due, geographic location or whatever. And print reports with subtotals and totals automatically calculated.

The CCA Data Management System, written by Creative Computer Applications, has two years of field testing on other microcomputers. Now Personal Software makes DMS available on the TRS-80 Level II and Apple II and II Plus 48k disk systems. And at under $100, DMS is also easy to afford.

One demonstration will convince you how easy computerized record keeping is. Ask your Personal Software dealer to show you. To locate your nearest dealer, contact Personal Software, Inc., (408) 745-7841, 592 Weddell Dr., Sunnyvale, CA 94086.

See us at NCC booth 48 and 49.

PERSONAL SOFTWARE

*Apple is a trademark of Apple Computer, Inc.; TRS-80 is a trademark of the Radio Shack Div. of Tandy Corp.

Circle 99 on inquiry card.

Listing 1 continued:

```
C24E 18          SERR   CLC            Z FLAG=1 MEANS ERROR
C24F 60                 RTS
C250 28          SUCC   PLP              RESTORE INTERRUPT
C251 A5 17              LDAZ   ALTH    ALTERNATE IN USE?
C253 F0 0D              BEQ    NOCQ    NO
C255 A5 07              LDAZ   LEN     YES , UPDATE ALTERNATE
C257 18                 CLC
C258 F0 06              BEQ    INCA    00 MEANS 100
C25A 65 16              ADCZ   ALTL
C25C 85 16              STAZ   ALTL
C25E 90 02              BCC    NOCQ
C260 E6 17       INCA   INCZ   ALTH
C262 18          NOCQ   CLC
C263 A9 FF              LDAIM  $FF     Z FLAG=0 MEANS GOOD READ
C265 60                 RTS

                 IN : READ A BYTE AND CHECK FOR OUT OF SECTOR

C266 AD 00 CC    IN     LDA    RDST    DATA READY?
C269 4A                 LSRA
C26A B0 0D              BCS    INQ     YES READ IT
C26C AD 02 CC           LDA    SECT    GET SECTOR FROM CONTROLLER
C26F 29 0F              ANDIM  $0F
C271 C5 02              CMPZ   DSEC    STILL RIGHT ONE?
C273 F0 F1              BEQ    IN      YES
C275 A9 03              LDAIM  BLNKSC  EMPTY SECTOR
C277 38                 SEC              ERROR FLAG
C278 60                 RTS
C279 AD 01 CC    INQ    LDA    RDTA    GET A BYTE
C27C 18                 CLC
C27D 60                 RTS



                 SECTION 3 WRITE ROUTINES



                 SAVX : SAVE A FILE ON DISK

C27E A9 00       SAVX   LDAIM  ZERO
C280 85 03              STAZ   BLTK    CLEAR BACK LINK
C282 85 04              STAZ   BLSC
C284 A2 01              LDXIM  $01
C286 B5 01       KLUP   LDAZX  DSTK    COPY TRACK/SECTOR
C288 95 0D              STAZX  PSTL    TO POSTAMBLE &
C28A 95 05              STAZX  FLTK    FORWARD LINK
C28C CA                 DEX
C28D 10 F7              BPL    KLUP
C28F 20 4C C3    SXS    JSR    FWDC    CALC FORWARD LINK
C292 20 2B C3           JSR    LNTH    CALC LENGTH
C295 A5 14              LDA    DPTL    MOVE DATA PTH
C297 85 08              STA    TCTL    TO TARGET
C299 A5 15              LDA    DPTH
C29B 85 09              STA    TGTH
C29D 20 CF C2    SXT    JSR    WSEX    WRITE A SECTOR
C2A0 B0 39              BCS    ERRO
C2A2 A5 07              LDAZ   LEN     GET LENGTH
C2A4 F0 07              BEQ    INCT    00=100
C2A6 18                 CLC
C2A7 65 14              ADCZ   DPTL    UPDATE DATA ADDRESS
C2A9 85 14              STAZ   DPTL
C2AB 90 02              BCC    NOCW
C2AD E6 15       INCT   INCZ   DPTH
C2AF A5 1F       NOCW   LDAZ   ENDH    IF TARGET GREATER
C2B1 C5 15              CMPZ   DPTH    THAN END
C2B3 F0 03              BEQ    CONT
C2B5 B0 09              BCS    SETU
C2B7 60          SRET   RTS              THEN RETURN
C2B8 A5 1E       CONT   LDAZ   ENDL
C2BA C5 14              CMPZ   DPTL
C2BC F0 02              BEQ    SETU
C2BE 90 F7              BCC    SRET
C2C0 A2 01       SETU   LDXIM  $01     ELSE PREPARE FOR NEXT SECTOR
C2C2 B5 01       SLUP   LDAZX  DSTK    MOVE TRACK/SECTOR TO
C2C4 95 03              STAZX  BLTK    BACKWARD LINK
C2C6 B5 05              LDAZX  FLTK    MOVE FORWARD LINK
C2C8 95 01              STAZX  DSTK    TO TRACK/SECTOR
C2CA CA                 DEX
C2CB 10 F5              BPL    SLUP
C2CD 30 C0              BMI    SXS     UNCONDITIONAL

                 WSEX : WRITE A SECTOR

C2CF 20 BA C0    WSEX   JSR    PREP    PREPARE DRIVE
C2D2 B0 08              BCS    WSQ     ERROR EXIT
C2D4 A9 01              LDAIM  $01
C2D6 2C 03 CC           BIT    DVST    WRITE PROTECT ON?
C2D9 D0 02              BNE    WSR     NO
C2DB 38          ERRO   SEC
C2DC 60          WSQ    RTS
C2DD 20 57 C1    WSR    JSR    CRC     COMPUTE CHECKSUM
C2E0 85 0B              STAZ   CKSL    SAVE IT
C2E2 A5 18              LDAZ   TPXH
C2E4 85 0C              STAZ   CKSH
C2E6 A9 FF              LDAIM  $FF     FILL CHAR FOR USRT
C2E8 8D 02 CC           STA    FILL

C2EB 08                 PHP            SAVE INTERRUPT STATUS
C2EC 20 47 C1           JSR    CTSC    FIND SECTOR
C2EF B0 37              BCS    WERR
C2F1 8D 04 CC           STA    WPLS    START TRANSMITTER
C2F4 A2 10              LDXIM  $10
C2F6 A9 00              LDAIM  $00
C2F8 20 63 C3    WSS    JSR    OUT     WRITE LEADER 16 X 00
C2FB CA                 DEX
C2FC D0 FA              BNE    WSS
C2FE A9 FB              LDAIM  $FB
C300 20 63 C3           JSR    OUT     SEND SYNC
C303 B5 01       WST    LDAZX  DSTK    WRITE 10 BYTE HEADER
C305 20 63 C3           JSR    OUT
C308 E8                 INX
C309 E0 0A              CPXIM  $0A
C30B D0 F6              BNE    WST
C30D A6 07              LDXZ   LEN     GET LENGTH
C30F A0 00              LDYIM  $00
C311 B1 14       WSU    LDAIY  DPTR    WRITE DATA
C313 20 63 C3           JSR    OUT
C316 C8                 INY
C317 CA                 DEX
```

Listing 1 continued on page 170

Listing 1 continued:

```
C318 DØ F7                  BNE    WSU
C31A AØ Ø4                  LDYIM  $Ø4
C31C B5 ØB           WSV    LDAZX  CKSL    WRITE CHECKSUM & POSTAMBLE
C31E 2Ø 63 C3               JSR    OUT
C321 E8                     INX
C322 88                     DEY
C323 DØ F7                  BNE    WSV
C325 28                     PLP            RESTORE INTERRUPT

C326 18                     CLC
C327 6Ø                     RTS
C328 28              WERR   PLP            RESTORE INTERRUPTS
C329 38                     SEC
C32A 6Ø                     RTS

                     LNTH : COMPUTE LENGTH AND FIND LAST BLOCK

C32B A5 1E           LNTH   LDAZ   ENDL    SUBTRACT TARGET
C32D 38                     SEC
C32E E5 14                  SBCZ   DPTL    FROM END
C33Ø 85 Ø7                  STAZ   LEN     TO GET LENGTH
C332 A5 1F                  LDAZ   ENDH
C334 E5 15                  SBCZ   DPTH    LAST BLOCK?
C336 FØ Ø5                  BEQ    LQ      YES
C338 A9 ØØ                  LDAIM  $ØØ     NO THEN LENGTH=1ØØ
C33A 85 Ø7                  STAZ   LEN
C33C 6Ø                     RTS
C33D E6 Ø7           LQ     INCZ   LEN
C33F 85 Ø5                  STAZ   FLTK    LAST BLOCK
C341 85 Ø6                  STAZ   FLSC    CLEAR FORWARD LINK
C343 A5 19                  LDAZ   EXCL
C345 85 ØD                  STAZ   PSTL    MOVE EXECUTION ADDRESS
C347 A5 1A                  LDAZ   EXCH
C349 85 ØE                  STAZ   PSTH
C34B 6Ø                     RTS

                     FWDC : CALCULATE FORWARD LINK. ASSUMES
                            FLTK =CURRENT TRACK

C34C A5 Ø6           FWDC   LDAZ   FLSC    GET CURRENT SECTOR
C34E C9 Ø8                  CMPIM  $Ø8     FIND NEXT ALTERNATE
C35Ø FØ ØC                  BEQ    FR      IF NOT 8
C352 BØ Ø4                  BCS    FQ      OR 9
C354 69 Ø2                  ADCIM  $Ø2     THEN ADD 2
C356 DØ Ø8                  BNE    FS      UNCONDITIONAL
C358 E6 Ø5           FQ     INCZ   FLTK    NEXT TRACK
C35A A9 ØØ                  LDAIM  $ØØ     FIRST SECTOR
C35C FØ Ø2                  BEQ    FS      UNCONDITIONAL
C35E A9 Ø1           FR     LDAIM  $Ø1
C36Ø 85 Ø6           FS     STAZ   FLSC    NEXT SECTOR
C362 6Ø                     RTS

                     OUT  : SEND A BYTE WHEN USRT IS READY

C363 48              OUT    PHA
C364 AD ØØ CC        OUTQ   LDA    RDST    USRT READY?
C367 1Ø FB                  BPL    OUTQ    NO, WAIT
C369 68                     PLA
C36A 8D Ø1 CC               STA    WDTA    SEND A BYTE
C36D 6Ø                     RTS



                     SECTION 4 KEYBOARD CONTROL ROUTINES




                     SAVK : ENTRY TO WRITE FILE
                            ENTER THE FOLLOWING VIA KIM:
                            BEGINNING ADDRESS       14,15
                            ENDING ADDRESS          1E,1F
                            EXECUTION ADDRESS       19,1A
                            DRIVE/TRACK/SECTOR      1C,1D
                            FILE TYPE               ØA

C36E 2Ø B5 C3        SAVK   JSR    INTCVT  INIT AND CONVERT
C371 BØ 15                  BCS    KERR    ERROR
C373 2Ø 7E C2               JSR    SAVX    WRITE FILE
C376 BØ 1Ø                  BCS    KERR
C378 2Ø 9Ø C3        LAST   JSR    CVTDEC  CONVERT D/T/S
C37B 4C 4F 1C        KIMQ   JMP    STRT    RETURN TO KIM

                     LODK : READ A MEMORY FILE
                            ENTER THE FOLLOWING
                            DRIVE/TRACK/SECTOR      1C,1D
                            ALTERNATE TARGET OR Ø  16,17

C37E 2Ø B5 C3        LODK   JSR    INTCVT  INIT AND CONVERT
C381 BØ Ø5                  BCS    KERR
C383 2Ø 89 C1               JSR    LODX    READ FILE
C386 9Ø FØ                  BCC    LAST    SHOW LAST TRK/SECTOR

C388 85 FA           KERR   STAZ   PNTL    ERROR CODE TO DISPLAY
C38A A9 FF                  LDAIM  $FF     ERROR FLAG
C38C 85 FB                  STAZ   PNTH
C38E DØ EB                  BNE    KIMQ

                     CVTDEC : CONVERT TRACK/SECTOR FOR DISPLAY

C39Ø A9 FF           CVTDEC LDAIM  $FF     ZERO COUNTE?
C392 85 FB                  STAZ   PNTH
C394 A5 Ø1                  LDAZ   DSTK    GET TRACK #
C396 29 3F                  ANDIM  TRKMSK  IGNORE DRIVE#
C398 38                     SEC
C399 E6 FB           LSQ    INCZ   PNTH
C39B E9 ØA                  SBCIM  $ØA     DIVIDE BY 1Ø LOOP
C39D BØ FA                  BCS    LSQ     BRANCH NO BORROW
C39F 69 ØA                  ADCIM  $ØA     REMAINDER IN A
C3A1 48                     PHA
C3A2 A5 Ø2                  LDAZ   DSEC    CONVERT ALTERNATE TO
C3A4 4A                     LSRA
C3A5 9Ø Ø2                  BCC    KSS     TO SEQUENTIAL SECTOR
C3A7 69 Ø4                  ADCIM  $Ø4     ADD 4 + CARRY
C3A9 85 FA           KSS    STAZ   PNTL    SAVE
C3AB 68                     PLA
C3AC ØA                     ASLA
C3AD ØA                     ASLA
C3AE ØA                     ASLA
C3AF ØA                     ASLA
C3BØ Ø5 FA                  ORAZ   PNTL    MERGE TRACK LSB
C3B2 85 FA                  STAZ   PNTL    WITH SECTOR
C3B4 6Ø                     RTS
```

Listing 1 continued on page 172



NEECO PROUDLY INTRODUCES

COMMODORE'S NEW 8000 SERIES (80 column) COMPUTERS





$1695 (available May/June '80)

CBM™ 8050 DUAL DRIVE FLOPPY DISK

The CBM 8050 Dual Drive Floppy Disk in an enhanced version of the intelligent CBM 2040 Disk Drive. The CBM 8050 has all of the features of the CBM 2040, and provides more powerful software capabilities, as well as nearly one megabyte of online storage capacity. The CBM 8050 supplies relative record files and automatic diskette initialization. It can copy all the files from one diskette to another without copying unused space. The CBM 8050 also offers improved error recovery and the ability to append to sequential files.

HARDWARE SPECIFICATIONS
- Dual Drives
- Two microprocessors
- 974K Bytes storage on two 5.25" diskettes (ss)
- Tracks 70
- Sectors 17-21
- Soft sector format
- IEEE-488 interface
- Combination power (green) and error (red) indicator lights
- Drive Activity indicator lights
- Disk Operating System Firmware (12K ROM)
- Disk Buffer (4K RAM)

FIRMWARE
- DOS version 2.0
- Sequential file manipulation
- Sequential user files
- Relative record files
- Append to sequential files
- Improved error recovery
- Automatic diskette initialization
- Automatic directory search
- Command parser for syntax validation
- Program load and save

CBM™ 8000 SERIES BUSINESS COMPUTERS

The new Commodore 8000 series computers offer a wide screen display to show you up to 80-character lines of information. Text editing and report formatting are faster and easier with the new wide-screen display. The 8000 series also provides a resident Operating System with expanded functional capabilities. You can use BASIC on the 8000 computers in both interactive and program modes, with expanded commands and functions for arithmetic, editing, and disk file management. The CBM 8000 series computers are ideally suited for the computing needs of the business marketplace.

SCREEN
- 2000 character display, organized into twenty-five 80-column lines
- 64 ASCII, 64 graphic characters
- 3 x 8 dot matrix characters
- Green phosphor screen
- Brightness control
- Line spacing: 1½ in Text Mode, 1 in Graphics Mode

KEYBOARD
- 73-key typewriter style keyboard with graphic capabilities
- Repeat key functional with all keys

MEMORY
- CBM 8016: 16K (15359 net) random access memory (RAM)
- CBM 8032: 32K (31743 net) random access memory (RAM)

POWER REQUIREMENTS
- Volts: 110V
- Cycles: 60 Hz
- Watts: 100

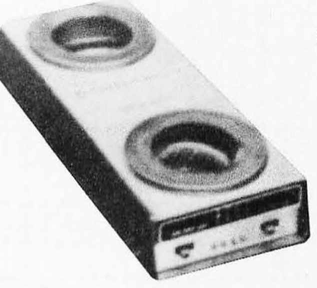
SCREEN EDITING CAPABILITIES
- Full cursor control (up, down, right, left)
- Character insert and delete
- Reverse character fields
- Overstriking
- Return key sends entire line to CPU regardless of cursor position

INPUT/OUTPUT
- Parallel port
- IEEE-488 bus
- 2 cassette ports
- Memory and I/O expansion connectors

FIRMWARE
- 24K or ROM contains: BASIC (version 4.0) with direct (interactive) and indirect (program) modes
- 9-digit floating binary arithmetic
- Tape and disk file handling software

The 8000 Series will be available May/June '80

Model 8016	Model 8032	2040 Dual Floppy
$1495	**$1795**	**$1295**



Available June/July

$395

CBM™ IEEE MODEM

SPECIFICATIONS
- *Full or half duplex operation
- *300 bits per second
- *Standard IEEE 488 interface
- *Switch selectable originate, off, answer-full duplex, test, half duplex
- *Visible indicators are transmit data, receive data, carrier ready, test
- *Frequency shifted modulation
- *Bell 103/113 compatible

"Exceceptional performance - even on noisy phone lines"

*CBM is a registered trademark of Commodore. All prices and specifications are subject to change without notice.



NEECO
679 Highland Ave.
Needham, MA
02194

Mon-Fri 9:30-5:30
MasterCharge & Visa Accepted
(617) 449-1760
Telex: 951021

MICROAMERICA DISTRIBUTING
"Nationwide distributors of Computer Equipment"
21 Putnam Street
Needham, MA
02194
(617) 449-4310

Listing 1 continued:

```
                        CVTBIN : CONVERT DECIMAL DRIVE/TRACK/SECTOR
                                 TO INTERNAL FORMAT

C3B5 20 18 C0   INTCVT JSR    INITDV INIT AND CONVERT

C3B8 A5 1D      CVTBIN LDA    TSSA
C3BA 29 0F             ANDIM SCTMSK EXTRACT SECTOR
C3BC C9 0A             CMPIM $0A    VALID?
C3BE B0 3C             BCS   INVS   NO
                CONVERT IT TO ALTERNATING SECTOR
C3C0 C9 05             CMPIM $05    LESS THAN 5?
C3C2 90 08             BCC   CDQ    YES
C3C4 38                SEC
C3C5 E9 05             SBCIM $05    MINUS 5
C3C7 0A                ASLA          MULTIPLY BY 2
C3C8 69 01             ADCIM $01    ADD 1
C3CA D0 01             BNE   CDR    UNCONDITONAL
C3CC 0A         CDQ    ASLA          MULTIPLY BY 2
C3CD 85 02      CDR    STAZ  DSEC   SAVE SECTOR
C3CF A5 1D             LDAZ  TSSA   GET HIGH NYBBLE
C3D1 4A                LSRA
C3D2 4A                LSRA
C3D3 4A                LSRA
C3D4 4A                LSRA
C3D5 C9 0A             CMPIM $0A    VALID?
C3D7 B0 23             BCS   INVS   NO
C3D9 85 01             STAZ  DSTK   SAVE LOW ORDER TRACK #
                MULTIPLY HI ORDER TRACK BY 10
C3DB A5 1C             LDAZ  DTSA
C3DD 29 0F             ANDIM $0F    CLEAR DRIVE #
C3DF 85 1B             STAZ  HIOR   SAVE
C3E1 0A                ASLA          MULTIPLY BY 4
C3E2 0A                ASLA
C3E3 18                CLC
C3E4 65 1B             ADCZ  HIOR   ADD ONCE (5X)
C3E6 0A                ASLA          MULTIPLY BY 2 (10X)
C3E7 65 01             ADCZ  DSTK   ADD LOW ORDER
C3E9 C9 23             CMPIM TRKLMT
C3EB B0 0F             BCS   INVS
C3ED 85 01             STAZ  DSTK
C3EF A5 1C             LDAZ  DTSA
C3F1 29 F0             ANDIM $F0    GET DRIVE #
C3F3 C9 40             CMPIM $40
C3F5 B0 05             BCS   INVS
C3F7 0A                ASLA
C3F8 0A                ASLA
C3F9 85 00             STAZ  DSDR
C3FB 60                RTS

C3FC A9 02      INVS   LDAIM $02    INVALID SECTOR
C3FE 60         THEEND RTS

   ALTH    0017   ALTL    0016   ALTP    0016   BADPRM  C0CD
   BLNKSC  0003   BLSC    0004   BLTK    0003   CDQ     C3CC
   CDR     C3CD   CKPH    001D   CKPL    001C   CKPT    001C
   CKSEC   C11F   CKSH    000C   CKSL    000B   CLUP    C22F
   CONT    C2B8   COPPL   C1A1   CQ      C17B   CRC     C157
   CRDR    001B   CRTK    000F   CTKP    0010   CTKQ    0011
   CTKR    0012   CTKS    0013   CVTBIN  C3B8   CVTDEC  C390
   CX      C172   DA      C0FE   DALP    C21D   DB      C100
   DELA    C085   DELSS   C13E   DEL     C083   DI      C109
   DISKMS  0000   DP      C11E   DPTH    0015   DPTL    0014
   DPTR    0014   DRIV    C0D0   DRVMSK  00CF   DRVTST  C095
   DS      C117   DSDR    0000   DSEC    0002   DSTK    0001
   DTSA    001C   DTSL    CC03   DVLUP   C09D   DVST    CC03
   ENDH    001F   ENDL    001E   ERRJ    C0F6   ERRO    C2DB
   EXCH    001A   EXCL    0019   FFTIME  C180   FILL    CC02
   FLSC    0006   FLTK    0005   FQ      C358   FR      C35E
   FS      C360   FTYP    000A   FWDC    C34C   GDAT    C21B
   GETP    C028   GTKX    C022   GTLUPA  C14D   GTLUPB  C150
   GTSC    C147   HEDLEN  000A   HIOR    001B   HLUP    C1FC
   IN      C266   INCA    C260   INCT    C2AD   INITDV  C018
   INQ     C279   INTCVT  C3B5   INTLUP  C01C   INVS    C3FC
   INVSEC  0002   KERR    C388   KIMDOS  C000   KIMQ    C37B
   KLUP    C286   KSS     C3A9   LAST    C378   LEN     0007
   LNTH    C32B   LODK    C37E   LODX    C189   LOOP    C0BB
   LQ      C33D   LSQ     C399   LUUP    C086   MILSEC  007D
   MISS    C12C   MOFF    CC06   MON     CC05   MTRBIT  0004
   MTVR    C047   NEND    C198   NOAL    C213   NOCQ    C262
   NOCW    C2AF   NOSEC   C1E3   OUTQ    C364   OUT     C363
   OVFL    C0C9   OVRUN   0004   PCH     00 0   PCL     00EF
   PNTH    00FB   PNTL    00FA   PREP    C0BA   PSTH    000E
   PSTL    000D   RCNT    001B   RDRT    C1C6   RDST    CC00
   RDS     C1C7   RDTA    CC01   READ    C1CB   READER  0005
   RETRIG  C0B1   ROK     C1E6   RQ      C1D8   RRST    CC04
   RSEX    C1AA   SAVEP   001B   SAVK    C36E   SAVX    C27E
   SCTBIT  0010   SCTMSK  000F   SECT    CC02   SEEX    C060
   SERR    C24E   SETL    C07F   SETU    C2C0   SKER    C246
   SLUP    C2C2   SOUT    C094   SRET    C2B7   START   C131
   STARTR  C144   STEPIN  0010   STIMER  C182   STPBIT  0020
   STPI    C06B   STPO    C076   STRT    1C4F   SUCC    C250
   SWIT    C0E7   SXS     C28F   SXT     C29D   SYNC    CC00
   TGTH    0009   TGTL    0008   TGTP    0008   THEEND  C3FE
   TJX     1705   TKIN    C040   TKOT    C038   TOUT    1707
   TPXH    0018   TRKLMT  0023   TRKMSK  003F   TSSA    001D
   WDTA    CC01   WERR    C328   WPLS    CC04   WPROT   0001
   WHTBIT  0008   WSEX    C2CF   WSQ     C2DC   WSR     C2DD
   WSS     C2F8   WST     C303   WSU     C311   WSV     C31C
   ZERO    0000
```

Listing 2: *Cross-reference table for the symbols in listing 1.*

```
SYMBOL      DEFINED     REFERENCES
ALTH        43          438  476  484
ALTL        42          441  481  482
ALTP        41
BADPRM      240         232
BLNKSC      110         498
BLSC        16          515
BLTK        15          432  514  548
CDQ         733         727
CDR         734         732
CKPH        53          332  338
CKPL        52          330  340
CKPT        51          343
CKSEC       292
CKSH        28          467  567
CKSL        27          459  464  565  595
CLUP        458         462
CONT        542         539
COPPL       380         374
CQ          348         346
CRC         329         463  564
CRDR        48          245  248  256
CRTK        31          147  175  179  180  184  185  250
                        262  272  281
CTKP        33          263  271
CTKQ        34
CTKR        35
CTKS        36
CVTBIN      721         124
CVTDEC      692         125  672
CX          343         337  350
DA          273
DALP        449         451  456
DB          274         275
DEL         191         159  168
DELA        195         188  310
DELSS       310         312
DI          279         252
DISKMS      107         223
DP          288         280
DPTH        40          331  440  447  526  536  538  615
DPTL        39          329  442  445  524  533  534  543
                        612
DPTR        38          453  589
DRIV        243         236
DRVMSK      95          153  156
DRVTST      207         279
DS          285         253  283
DSDR        12          246  762
DSEC        14          230  296  376  428  496  702  734
DSTK        13          172  233  378  422  426  517  547
                        550  582  694  742  752  755
DTSA        54          744  756
DTSL        79          158  161  166  278
DVLUP       210         216  219
DVST        70          142  152  155  211  243  274  305
                        560
ENDH        57          537  614
ENDL        56          542  610
ERRJ        223         213  300
ERRO        562         529
EXCH        46          625
EXCL        45          623
FFTIME      356         209  318
FILL        78          569
FLSC        18          371  375  622  632  642
FLTK        17          373  377  519  549  621  638
FQ          638         635
FR          641         634
FS          642         637  640
FTYP        23
FWDC        632         126  522
GDAT        448         443
GETP        141         145
GTKX        139         284  393
GTLUPA      319         320
GTLUPB      321         322
GTSC        317         409  572
HEDLEN      98          341
HIOR        49          746  750
HLUP        431         435
IN          491         415  420  427  431  458  497
INCA        484         480
INCT        536         531
INITDV      130
INQ         501         493
INTCVT      719         668  680
INTLUP      132         134
INVS        765         724  741  754  759
INVSEC      109
KERR        685         669  671  681
KIMDOS      10
KIMQ        673         688
KLUP        517         521
KSS         706         704
LAST        672         683
LEN         19          333  455  478  530  587  613  618
                        620
LNTH        610         523
LODK        680
LODX        369         122  379  682
LOOP        198         199
LQ          620         616
LSQ         697         699
LUUP        196         201
MILSEC      93          196
MISS        298         293
MOFF        73
MON         72          167  308
MTRBIT      92          304
```

Listing 2 continued on page 176

DO IT

University Software gives you



Canned Programs are Only a Beginning. Preprogrammed disks and cassettes are a terrific way to get started in micros. But they're just a start. The best thing about owning a computer is programming it. Yourself.

University Software makes it easy. Using compact, easy-to-understand Microsoft BASIC, *University Software* has selected the best work of scores of different authors to create this spiral-bound, five-volume set of the programs you most want to have. All you have to do is sit down at the keyboard and enter them.



Software for People. The problem with BASIC as a language is that it was developed on timeshare and other large capacity computers. But Microsoft BASIC was specifically designed to run on micros; it's fast, it's simple, and memory requirements are minimal.

All the programs in the *University Software* set were written on micros, for micros. If you own a TRS-80, Apple, Texas Instruments, Atari, Commodore PET, Sorcerer, or Ohio Scientific micro, these programs were designed to work right—the first time—on your machine.

What's more, they're programs you can use. The Small Business text contains programs to help you look at interest rates every possible way, a materials inventory program, a touch typing course and a small business accounting system. But that's only the beginning. Among the Education and Scientific programs, you'll find a speed reading course, a President's quiz, a math education program, and programs to help you learn English and build your vocabulary. The two vol-

---

A University Software Sampler

Here is a small sample of the programs you'll get in each of the five University Software *volumes.*

HOME & ECONOMICS–$24.95
Text Editor: Compose and correct your notes, letters, invoices.
Utilities: Electric, water, phone, gas and trash bills control.
Temperature Conversion: Lets you convert different temperature units.
Eternal Calendar: Returns the day of the week for a given date.
Recipes Book: Sets up recipes on cassette tape.
Checking Account: Checkbook analysis.
...Plus 9 more!

FUN & GAMES Volume I–$14.95
Space Race: You command Federation Trading Ships in the Asteroid Belt.
Mastermind: Players attempt to figure out one another's combinations.
Combat: Battle game employing numbered board on screen.
Biorhythm: Physical, emotional and intellectual patterns.
Merchant of Venus: Make money in outer space.
...Plus 10 more!

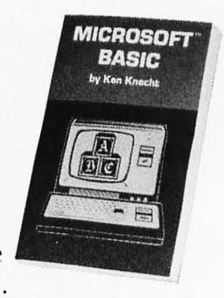
FUN & GAMES Volume II–$14.95
Blackjack: The famous card game.
World War III: War game.
Bridge: Deals four hands on screen.
Battlestar Galactica: You have to reach Earth passing many Cylon stations.
...Plus 17 more!

EDUCATION & SCIENTIFIC–$34.95
Astronomical Computations: Compute the positions of the planets; draw orbits.
Pythagorean Theorem: Review geometry theorems.
Word Search: Spelling puzzle.
Quantum Chemistry: Compute quantum numbers of an atom.
Program Manager: Load and run multiple programs.
...Plus 21 more!

SMALL BUSINESS–$49.95
Mortgage Analysis: Outputs loan tables.
Distributions Mapping: Maintains library of distribution functions.
Billing System: Creates and manages data base containing bills.
Investment Management: Analysis of stocks, funds, debentures, real estate.
Small Business Accounting: Posts income and expenses, prints trial balance; chart of accounts.
Tax: Federal Income and F.I.C.A. taxes.
...Plus 22 more!

Act now for your FREE BOOK

You can order each of these volumes separately NOW through Folio Books. But if you call today and order the entire set, we'll include *Microsoft BASIC*, a standard introductory guide to the use of the language by Ken Knecht absolutely FREE.



Offer expires June 30, 1980

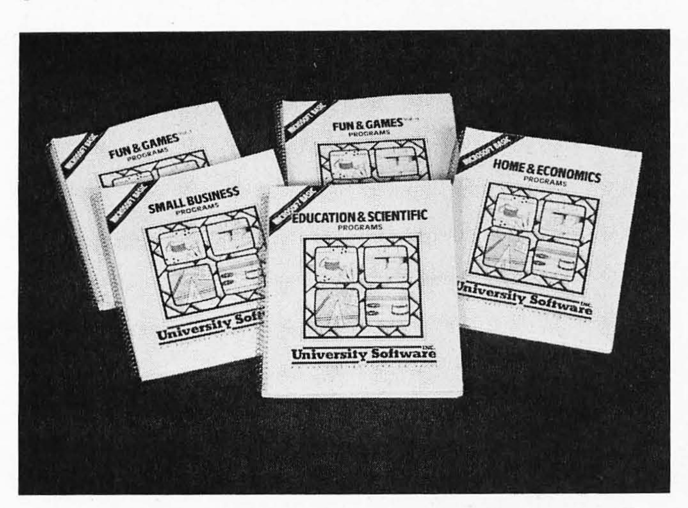
YOURSELF.

105 Microsoft programs. For less than a buck and a half apiece.

umes of Fun & Games programs offer a total of 35 games and graphics to challenge every level of skill. Finally, the Home & Economics text contains the programs you need to help you manage your life more efficiently—an appointments calendar, metric conversions, and programs to help you balance your checking account and budget the family income.

Do Your Pocketbook a Favor. It's this simple: if you input your own programs, you save money. Lots of money. Preprogrammed cassettes and disks nowadays cost anywhere from $10 to upwards of $50. And if the program you want is not available in a format for your computer, you're just flat out of luck.

If you buy the entire set of *University Software* programs, on the other hand, you get 105 programs for $139.75—about $1.33 each. Plus, there's a conversion appendix in the back of *each* volume to help you convert any Microsoft BASIC program written on one computer to run on yours.



Do Yourself a Favor. To really master and understand your computer, you can't be content to sit back and let *it* do all the work. You've got to roll up your sleeves and accept the challenge to your own creativity. *University Software* programs will help you run your life. And they'll help you grow.

You can order any of the *University Software* volumes separately, but if you *act now* and order the entire set, we'll include Ken Knecht's *Microsoft BASIC*, a complete introduction and tutorial book on programming in Microsoft BASIC, *FREE!* It's yours—a $10 value—just for ordering the whole *University Software* set at one time.



We'll jump right on your order. There's only one place you can get the entire *University Software* set shipped directly to you almost as soon as you call: Folio Books. We are specialists in computer books for micro and mini computers, and honestly believe that *University Software* is the finest set of application Microsoft programs available to the general public.

Call us today. Do it for yourself.

ORDERING INFORMATION: Call toll-free (800) 423-4864, M-F 9-5 p.m. Pacific Time. Mail order: include name, address and telephone. M/C and Visa customers include: your name as it appears on your card, card number, expiration date. All orders add $1.00 per volume for shipping and handling. California residents add 6% sales tax. We ship UPS or Parcel Post. Introductory offer: order 3 or more volumes and receive a 10% discount; order all 5 and we also pay shipping anywhere in U.S.A.

(800) 423-4864

In California call collect: (213) 795-5224

University Software is available from

Folio Books

P.O. Box 4100-H, Los Angeles, California 90041

University Software Also Available at Leading Computer Stores Everywhere.

Circle 103 on inquiry card.

Listing 2 continued:

```
MTVR      158     154
NEND      376     372
NOAL      444     439
NOCQ      485     477  483
NOCW      537     535
NOSEC     417     41Ø
OUT       647     577  581  583  59Ø  596
OUTQ      648     649
OVFL      237
OVRUN     111     237
PCH       6Ø      383
PCL       59      381
PNTH      62      687  693  697
PNTL      61      685  7Ø6  712  713
PREP      23Ø     123  388  557
PSTH      3Ø      382  626
PSTL      29      38Ø  518  624
RCNT      5Ø      4Ø5  47Ø
RDRT      4ØØ     37Ø  389  391  392  396  397
RDS       4Ø4     39Ø  395
RDST      67      449  491  648
RDTA      68      452  5Ø1
READ      4Ø6     472
READER    112     398
RETRIG    22Ø
ROK       42Ø     416
RQ        412     413
RRST      71      414
RSEX      388     119  369
SAVEP     47      215  217
SAVK      668
SAVX      513     121  67Ø
SCTBIT    1Ø1     21Ø
SCTMSK    97      295  722
SECT      69      294  494
SEEX      172     286  394
SERR      473     471
SETL      187     148  182
SETU      546     54Ø  544
SKER      469     424  429  465
SLUP      547     552
SOUT      2Ø3     176
SRET      541     545
START     3Ø4     285
STARTR    313     3Ø6
STEPIN    96      157
STIMER    357
STPBIT    1Ø2     16Ø
STPI      178     181
STPO      183     177  186
STRT      86      673
SUCC      475     468
SWIT      255     249
SXS       522     553
SXT       528
SYNC      76      4Ø7
TCTH      22      446  527
TCTL      21      444  525
TCTP      2Ø
THEEND    766
TJX       84      197
TKIN      155     139  14Ø  178
TKOT      152     141  183
TOUT      85      198  212  292  358
TPXH      44      336  345  466  566
TRKLMT    1ØØ     235  753
TRKMSK    99      173  234  423  695
TSSA      55      735
WDTA      77      651
WERR      6Ø4     573
WPLS      8Ø      574
WPROT     1Ø8
WRTBIT    91      273
WSEX      557     12Ø  528
WSQ       563     558
WSR       564     561
WSS       577     579
WST       582     586
WSU       589     593
WSV       595     599
ZERO      94      3Ø9  334  342  347  43Ø  448  513

OPCODE USAGE TABLE
    *   63      ADC  9      AND  15     ASL  12
    BCC 11      BCS  22     BEQ  22     BIT  3
    BMI 1       BNE  31     BPL  4      CLC  12
    CMP 18      CPX  3      CPY  4      DEC  2
    DEX 8       DEY  3      EOR  3      INC  6
    INX 5       INY  3      JMP  15     JSR  43
    LDA 85      LDX  14     LDY  5      LSR  9
    NOP 3       ORA  3      PHA  5      PHP  2
    PLA 7       PLP  5      ROL  7      RTS  28
    SBC 4       SEC  1Ø     SEI  1      STA  59
    STX 3       TAX  3      TAY  4      TYA  1

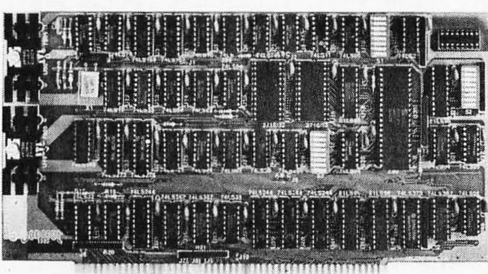
ADDRESS MODE OCCURENCES
    AY Ø        AX Ø        ZX 13
    ZY Ø        IM 74       IX Ø
    IY 3        Z  97       A  27
    NONE 362
```

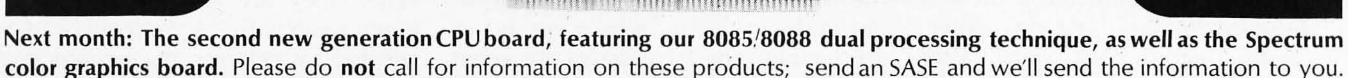
the FIRST of the New Generation

Our innovative **Z-80A CPU board** is truly the first of a new generation of S-100 bus equipment . . . a generation that's designed to accomodate multi-user setups and other high level industrial, scientific, and commercial applications.

This CPU card contains all the good Z-80 features of other boards, but also features full compliance with the proposed IEEE S-100 bus standards, provision for adding two EROMs for 4K to 8K of on-board ROM (2716 or 2732 – not included with board), power on jump to any of 256 boundaries, on-board fully maskable interrupts at port FE (hex) for interrupt driven systems, 2 or 4 MHz operation, power on clear that generates preset and slave clear according to IEEE specs, selectable automatic wait state insertion for servicing M1* instructions – MRQ* – I/O RQ* – or the on-board ROM (individually or severally selectable), non-maskable interrupt on bus pin 12 as per IEEE specs, and we've also included on-board IEEE compatible extended addressing at port FD (hex).

These advanced features give you the power you need for future expansion, as well as the system flexibility that comes from superior design . . . but perhaps best of all, the price is competitive with boards that do a whole lot less. **The Z-80A CPU board is available for $225 unkit, $295 assembled, and $395 for units qualified under our Certified System Component program.**





Next month: The second new generation CPU board, featuring our 8085/8088 dual processing technique, as well as the Spectrum color graphics board. Please do **not** call for information on these products; send an SASE and we'll send the information to you.

HIGH PERFORMANCE S-100 MOTHERBOARDS

6 slot: $89 unkit, $129 assm

12 slot: $129 unkit, $169 assm **19 slot: $174 unkit, $214 assm**

Ideal for use with the above enclosure. **Unkits** have edge connectors and termination resistors pre-soldered in place for easy assembly. Meets or exceeds IEEE S-100 specs; includes true active termination, grounded Faraday shield between all bus signal lines, and edge connectors for all slots.

LOOKING FOR MEMORY?

Our boards are static, run up to 5 MHz, meet the IEEE S-100 standards, low in power, and include a 1 year warranty. Choose from **unkit** (sockets, bypass caps pre-soldered in place), **assembled**, and boards qualified under our high-reliability **Certified System Component** (CSC) program.

Memory Name	Buss & Notes	Unkit	Assm	CSC
8K Econoram* IIA	S-100	**$169**	**$189**	**$239**
16K Econoram XIV	S-100 (1)	**$299**	**$349**	**$429**
16K Econoram X-16	S-100	**$329**	**$379**	**$479**
16K Econoram XIIIA-16	S-100 (2)	**$349**	**$419**	**$519**
16K Econoram XV-16	H8 (3)	**$339**	**$399**	n/a
16K Econoram IX-16	Dig Grp	**$319**	**$379**	n/a
24K Econoram VIIA-24	S-100	**$449**	**$499**	**$599**
24K Econoram XIIIA-24	S-100 (2)	**$479**	**$539**	**$649**
32K Econoram X-32	S-100	**$599**	**$689**	**$789**
32K Econoram XIIIA-32	S-100 (2)	**$649**	**$729**	**$849**
32K Econoram XV-32	H8 (3)	**$649**	**$749**	n/a
32K Econoram IX-32	Dig Grp	**$599**	**$679**	n/a
32K Econoram XI	SBC/BLC	n/a	n/a	**$1050**

Econoram is a trademark of **Godbout Electronics.**

(1) Extended addressing (24 address lines). Addressable on 4K boundaries.
(2) Compatible with all bank select systems (Cromemco, Alpha Micro, Etc.); addressable on 4K boundaries.
(3) Bank select option for implementing memory systems greater than 64K.

THE GODBOUT COMPUTER BOX

$289 desktop, $329 rack mount

Quiet fan, dual AC outlets and fusehold, heavy-duty line filter, black anodized front panel, and card guide. Ask about our matching power supply.

S-100 2708 EROM BOARD $85 unkit

4 independently addressable 4K blocks. Includes all support chips and manual, but does not include 2708 EROMs.

S-100 ACTIVE TERMINATOR BOARD $34.50 kit

Plugs into older, unterminated motherboards to improve performance.

S-100 MEMORY MANAGER BOARD

$59 unkit, $85 assm, $100 CSC

Adds bank select and extended addressing to older S-100 machines to dramatically increase the available memory space.

2S "Interfacer I" S-100 I/O BOARD

$199 unkit, $249 assm, $324 CSC

Dual RS-232 ports with full handshake. On-board crystal timebase, hardware UARTS, much more.

3P PLUS S "INTERFACER II" I/O BOARD

$199 unkit, $249 assm, $324 CSC

Includes 1 channel of serial I/O (RS-232 with full handshake), along with 3 full duplex parallel ports plus a separate status port.

PASCAL/M™ + MEMORY SPECIAL

PASCAL can give a microcomputer with CP/M more power than many minis. You can buy our totally standard **Wirth PASCAL/M™ 8" diskette**, with manual and Wirth's definitive book on PASCAL, **for $150 with the purchase of any memory board**. Specify Z-80 or 8080/8085 version. PASCAL/M™ available separately for $350.

SEE COMPUPRO PRODUCTS IN PERSON: Many of these products are stocked by finer computer stores world-wide, or write us if there's no dealer in your area.

TERMS: Cal res add tax. Allow 5% for shipping, excess refunded. VISA*/Mastercharge* call our 24 hour order desk at **(415) 562-0636.** COD OK with street address for UPS. Sale prices good through cover month of magazine; other prices are subject to change without notice.



from



Bldg. 725, Oakland Airport, CA 94614 (415) 562-0636

Circle 104 on inquiry card.

Text continued from page 158:
particles from the head surface. In addition, this operation insures that the head is on the proper track. Another three reads are attempted; if this fails, the data is assumed to be unrecoverable.

The memory locations that must be initialized before a read operation are given in table 4.

The write routines write a contiguous block of memory to the disk on the required number of sequential sectors. They are also responsible for calculating the forward and backward links and the check sum for each sector. Each sector except the last contains 256 bytes of data; if the number of bytes to be saved is not an integer multiple of 256, the last sector may be shorter. Each sector is preceded by 16 bytes of 0s before the sync character. This is followed by the sector header, the data, and the trailer. No read operation is done after writing to verify the data, because the infrequency of write errors does not warrant the extra overhead.

The memory locations that must be initialized before an area of memory can be saved on disk are given in table 5.

Control Routines

The routines SAVK and LODK provide the interface between the user and the disk routines. These routines expect the appropriate information to be preset in memory by use of the KIM keyboard. The only incompatibility with the Percom MINIDOS routines here is in the indication of an omitted value. The Percom routines use the value hexadecimal FFFF to indicate a field not in use, and KIMDOS uses a high-order byte of 0. This is not important since the 6800 and 6502 microprocessors store their high- and low-order address bytes in the opposite order and are not compatible anyway.

The control routines SAVK and LODK convert their parameters into the proper format where necessary and call the disk subroutines. Upon return, these two routines display the results of the requested operation on the KIM display and return control to the KIM monitor. The information displayed is either the DTS number of the last sector read or written in decimal, or FF*nn*, where *nn* is an error code. The error codes are given in table 6.

Interrupts

In any system, it is often desirable to use interrupts for various processes. Because KIMDOS is involved in time-critical functions when doing disk input/output (I/O), an interrupt at the wrong time could cause catastrophic errors. Therefore, the nonmaskable interrupt (NMI) line cannot be used during disk I/O.

However, KIMDOS does allow for the use of the maskable interrupt request (IRQ) line. This is done by saving the status register and disabling the IRQ line before starting any time-critical functions. The status register is then restored after the critical function is completed. This causes the servicing of the IRQ interrupt to be delayed for as much as 20 ms at a time. Any interrupt-driven system that can tolerate this limitation can function properly with KIMDOS.

Testing

Since the drive and controller both come assembled and tested, the checkout procedure is relatively simple. The only equipment I used was a logic probe and a multimeter.

The first step is to connect the drive and controller to the KIM bus and verify all power-supply voltages. When they are correct, basic communication with the controller can be verified by entering the hexadecimal address CC05 via the KIM-1 keypad. This should start the motor and keep it on until the address is changed. If the motor does not start, then there is probably a bad connection to KIM.

Next, the motor-off pulse can be checked by pressing the + key on the KIM keypad to increment the address on the display to hexadecimal CC06. This should turn off the motor immediately. The motor time-out circuit can be checked by entering hexadecimal CC05 on the KIM display,

Hexadecimal Address	Contents
0016, 0017	Beginning memory address (optional; substitute 0 to use address stored in the disk file)
001C, 001D	Drive/Track/Sector (DTS) number of first sector in the file being read

Table 4: *Information required to read a file into memory from disk. The file being read into memory will begin at the address pointed to by hexadecimal memory locations 0016 and 0017. However, if the contents of these two bytes are 0, the file will be loaded into memory beginning at the address stored with the file. The DTS number is stored here in binary-coded decimal format, with the high-order byte stored first.*

Hexadecimal Address	Contents
0008, 0009	Beginning address of memory to be saved
000A	File type
0019, 001A	Execution address (optional ; use 0 to omit)
001C, 001D	Drive/Track/Sector number of first sector to be written
001E, 001F	Ending address of memory to be saved

Table 5: *Information required to save a file. These are the hexadecimal memory locations that must be set before the SAVK (save a file) routine from listing 1 is called. The DTS number is stored here in binary-coded decimal format, with the high-order byte stored first.*

Error Code	Message
0	Disk missing (given after read or write operation)
1	Disk protected (given after write operation only)
2	Invalid sector number (given after read or write operation)
3	Blank sector (given after read operation only)
4	Disk overrun; attempted to write more than 349 sectors
5	Permanent read error

Table 6: *List of disk-related error codes. If a read or write operation ends in failure, the left four digits of the KIM display will read FFnn, where* nn *is one of the error codes listed in this table.*

The 1980's: Hard Disks

for your Microcomputer! Cromemco, North Star and other S-100; TRS-80® ; SuperBrain® ; Apple, Alpha Micro, et. al. . . .



Cromemco Z-2H

Full 11-megabyte Hard Disk System

- Fast Z80A 4 MHz processor
- 11-megabyte Hard Disk Drive
- Two Floppy Disk Drives
- 64K RAM Memory
- RS232 Special Interface
- Printer Interface
- Extensive software available

List $9995
MiniMicroMart price: **$8489**

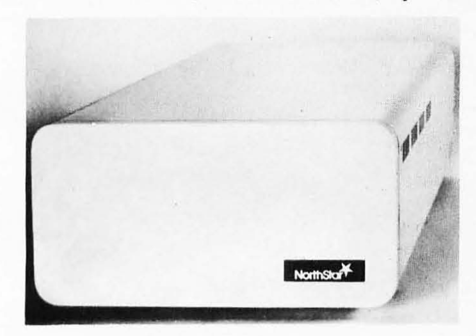
CROMEMCO HDD

11/22 megabyte Hard Disk System, for use with existing systems. DMA controller, transfer rate of 5.6 megabytes per second.

HDD-11, single drive, List $6995
OUR PRICE $5,939
HDD-22, dual drive, List $11,995
OUR PRICE $10,189

NORTH STAR HD-18

18 megabytes (expandable to a 4-drive system). North Star uses a tried-and-proved 14" Century Data Marksman. The interface is through the North Star parallel port and runs with existing software. List $4,999
OUR PRICE $4,199



CORVUS *for TRS-80/Apple/S-100*

The Corvus and Lobo interfaces use the new IMI 7710 8" Winchester with 10 megabytes of formatted storage. Either system is available from MiniMicroMart. The Corvus is $5,300 list
OUR PRICE $4,795

MICROAGE

MicroAge has for some time been marketing hard disk interfaces to the North Star Horizon and to the Alpha Micro System. They have utilized the Konan controller with two popular drives: The Control Data 9448 (PHOENIX) with 32 megabytes of capacity and the Fujitsu M-2201 with 50 megabytes.

EITHER MODEL, List $9,995 . . **$7,495**

Call us for Dynabyte and Vector Graphic

MICROMATION

Comes another array of hard disks, utilizing 14" Shugarts. Their model MD-I utilizes the Shugart 4001, which provides for over 10 megabytes of formatted storage. The Model MD-II utilizes a Shugart 4008, and provides for over 20 megabytes of formatted storage.

MD-I, List $5,995 . **our price $5,095**
MD-II, List $6,995 . . . . $5,945

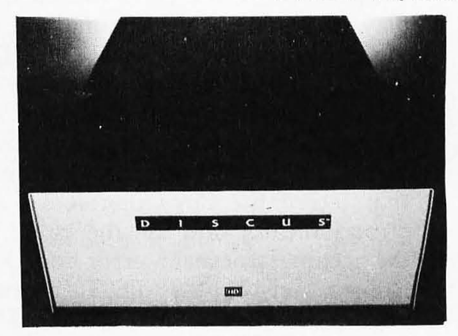
XCOMP KB10

One of the early firms to bring a hard disk to the S-100 bus, it interfaces to the popular, removable cartridge types of disk drive, which have become an industry standard for mini-computers over the past few years. They supply a system utilizing the top-loading 5440-type of cartridge. These drives have been traditionally available with one fixed drive on the bottom with a removable cartridge on top. Some operate at 100 tracks per inch, with a high-density one operating at 200 tracks per inch. The high-density unit allows storage of 5 megabytes per cartridge, or 10 megabytes per drive. The XCOMP controller provides for handling four drives, for a total capability of 40 megabytes. Since the top cartridge is removable, back-up is simple, fast, and practical.

CALL US FOR PRICE!

MORROW THINKER TOYS* DISCUS M26™

26 megabytes of formatted storage (expandable to 104 megabytes). The system is complete with Shugart SA-4008 14" Winchester, cabinet, power supply, controller board, and CP/M 2.0. It features a 512-byte sector buffer on board; each sector can be individually write-protected for data base security. The S-100 controller incorporates intelligence to supervise all data transfers and communicates with a CP/U via 3 I/O ports (command, status, data). The controller has the ability to generate interrupts at the completion of each command to increase system through-put.
List $4,995
ONLY $4,199



SHIPPING AND INSURANCE: Most Hard Disk Systems are shipped freight collect.

All prices subject to change and all offers subject to withdrawal without notice.

Prices in this ad are for prepaid orders. Slightly higher prices prevail for other-than-prepaid orders, i.e., C.O.D., credit card, etc.

— WRITE FOR FREE CATALOG —



MiniMicroMart, Inc.

master charge THE INTERBANK CARD

1618 James Street, Syracuse, NY 13203 (315) 422-4467 TWX 710-541-0431

Circle 105 on inquiry card.

Hard sectoring means that sector boundaries are detected by means of holes punched in the floppy disk.

followed by another address. The motor should run about 3 seconds and stop.

Now the sector-counting circuitry can be checked. With a disk inserted in the drive, enter hexadecimal CC05 and then hexadecimal CC02. The rightmost digit of the KIM display (which shows the low nybble of the contents of hexadecimal location CC02) should be rapidly changing as long as the motor is running. When the motor stops, this digit should contain a decimal digit (0 thru 9) indicating the last sector passed.

After all of the previously mentioned tests have been completed, the software can be used to do further testing. The TEST routine, given in listing 3, is included for this purpose. TEST does a static test of most of the controller functions and their interaction with various subroutines within KIMDOS. It uses the number of the key pressed on the keypad as an index into a table of subroutine addresses. From there, it does a subroutine jump to the routine thus addressed.

Upon return, the TEST routine displays the value of the accumulator in the rightmost two digits of the KIM display. It also displays the value of the carry flag in the left four digits — FFFF for carry set and 0000 for carry clear. (This is done for those routines that return the carry flag set as an error indicator and use the value in the accumulator as an error code.)

Execution of the TEST routine begins at hexadecimal 0200. The appropriate data must be set in the 0 page for the subroutines to be tested. Some subroutines must be used together. For example, the motor must be started and the drive must be selected before the head-movement routines will work. To add more subroutines, increase the value in the compare instruction at hexadecimal location 020C and add the appropriate addresses to the end of the table.

The final test that I had to do was

Listing 3: *Listing for program TEST. This program executes a given KIMDOS routine (see documentation at the beginning of the listing) depending on which key on the KIM keypad is pressed.*

```
Hexadecimal  Object  Label  Instruction  Operand    Commentary
Address      Code           Mnemonic

                        TEST : ROUTINE TO TEST THE BASIC DISK
                                 DRIVER SUBROUTINES

                        SUBROUTINES UNDER TEST

                     SUB            ADDRESS   KEY#
2000                 GTKX    *      $C022       0    GO TO TRACK 0
2000                 PREP    *      $C00C       1    PREPARE DRIVE FOR I/O
2000                 START   *      $C131       2    START MOTOR
2000                 TKOT    *      $C038       3    MOVE HEAD OUT 1
2000                 TKIN    *      $C040       4    MOVE HEAD IN 1
2000                 SEEX    *      $C060       5    FIND TRACK IN 01
2000                 GTSC    *      $C147       6    FIND SECTOR IN 02
                                                7    RETURN TO KIM

                        KIM ADDRESSES

2000                 SCND    *      $1F1F
2000                 GETK    *      $1F6A
2000                 KIM     *      $1C4F

                        ZERO PAGE STORAGE

2000                 TOAD    *      $0020
2000                 TODQ    *      $0021
2000                 SAKE    *      $0022
2000                 PNTH    *      $00FB
2000                 PNTL    *      $00FA
2000                 INH     *      $00F9

2000                        ORG    $2000

2000 20 1F 1F  STAR   JSR    SCND   LITE DISPLAY
2003 20 6A 1F         JSR    GETK   GET KEY
2006 C5 22            CMPZ   SAKE   DEBOUNCE
2008 F0 F6            BEQ    STAR
200A 85 22            STAZ   SAKE
200C C9 08            CMPIM  $08    VALID?
200E B0 F0            BCS    STAR   NO
2010 0A               ASLA          YES, MULTIPLY BY 2
2011 AA               TAX           TO GET INDEX
2012 BD 32 20         LDAAX  TABL   MOVE OBJECT ADDRESS
2015 85 20            STAZ   TOAD   TO JUMP VECTOR
2017 E8               INX
2018 BD 32 20         LDAAX  TABL
201B 85 21            STAZ   TODQ
201D 20 2F 20         JSR    JMPP   CALL SUBROUTINE
2020 85 F9            STAZ   INH
2022 A9 FF            LDAIM  $FF    ERROR FLAG
2024 B0 02            BCS    STOR   BRANCH ON ERROR
2026 A9 00            LDAIM  $00    GOOD FLAG
2028 85 FA     STOR   STAZ   PNTL
202A 85 FB            STAZ   PNTH
202C 4C 00 20         JMP    STAR
202F 6C 20 00  JMPP   JMI    TOAD

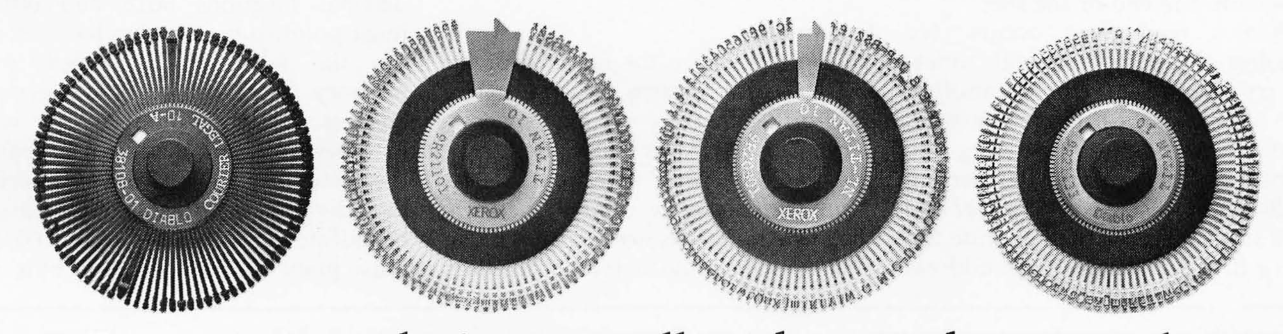
2032 22        TABL   =      GTKX
2033 C0               =      GTKX   /
2034 0C               =      PREP
2035 C0               =      PREP   /
2036 31               =      START
2037 C1               =      START  /
2038 38               =      TKOT
2039 C0               =      TKOT   /
203A 40               =      TKIN
203B C0               =      TKIN   /
203C 60               =      SEEX
203D C0               =      SEEX   /
203E 47               =      GTSC
203F C1               =      GTSC   /
2040 4F               =      KIM
2041 1C               =      KIM    /

   GETK   1F6A   GTKX   C022   GTSC   C147   INH    00F9
   JMPP   202F   KIM    1C4F   PNTH   00FB   PNTL   00FA
   PREP   C00C   SAKE   0022   SCND   1F1F   SEEX   C060
   STAR   2000   START  C131   STOR   2028   TABL   2032
   TKIN   C040   TKOT   C038   TOAD   0020   TODQ   0021
```

Diablo introduces the first printer that runs on four wheels.

The Diablo 630 printer is the most versatile printer you can get.

It's the only one that gives you a choice of 4 different interchangeable print wheels and over 100 different type styles.



Every 630 works just as well with a 96-character plastic daisy print wheel as it does with an 88, 92, or 96-character metal daisy print wheel.

The 630 also has fewer moving parts than competitive printers, which makes it exceptionally reliable.

This new addition to our line offers unsurpassed print quality. Compatibility with existing Diablo supplies. And automatic bi-directional printing.

The Diablo 630 printer.

Probably the best thing to happen to printing since we re-invented the wheel.

Diablo

Diablo Systems

Visit us at NCC Booth 1631 and Personal Computing Festival Booths 79 & 80.



Circle 106 on inquiry card.

to read and write data using a floppy disk previously recorded in the Percom format. I did this to confirm that the KIMDOS software produces results using the controller board and disk that are identical to the results produced by the Percom 6800 code. Since I found this to be the case, no one using KIMDOS needs to repeat that test.

Alternating-sector addressing allows time for the housekeeping routines that must be executed between reading and writing sectors.

Error Recovery

As in all systems, there will occasionally be unrecoverable errors. The Percom format allows for recovery of broken files. Since each sector contains the DTS number of the first sector of the file, each sector can be associated with its file. Reading does not have to start with the first sector; it can start on any sector and will continue to the end of the file.

When a read error occurs, try rereading the sector several times. Also try to read a sector on another track of the disk (to move the head around some) before rereading the original sector in error. Reinserting the disk may also help. If all of the above measures fail, then execute the routine LAST at hexadecimal address C378. This will display the number of the sector containing the error. To try a partial recovery, start the read operation at one sector past the displayed address. If that fails, try the next sector, and so on. Any valid sector can be read in this way. A file may have only one bad sector, with the rest readable.

Expansion

To fully utilize the features of the LFD-400 disk system, a more extensive disk-operating system is necessary. This software is designed to be the basis of such a system. These subroutines can be used to perform the basic functions needed by a larger disk-operating system that provides for named files, automatic space management, and buffered I/O.

To facilitate expansion, KIMDOS has a jump table located at the beginning of the executable code that contains JMP instructions to all subroutines in KIMDOS needed by external software. This allows KIMDOS to be updated (in case of bugs or enhancements) without reassembling the calling routines. With the nine routines in the jump table, any disk I/O can be performed under external program control.

RSEX and WSEX are used to read and write individual sectors. To use them, the data at hexadecimal locations 0000 thru 000A must be supplied. (See the beginning of listing 1.) To read an individual sector, the alternate address pointer, hexadecimal locations 0016 and 0017, must point to the starting location of the file when it is loaded into memory. If the value of the alternate address pointer is 0, the sector will load beginning at an address stored in the sector header. Similarly, to write an individual sector, the data pointer, hexadecimal locations 0014 and 0015, must point to the beginning byte of

Circle 108 on inquiry card.

Since the drive and controller both come assembled and tested, the checkout procedure is relatively simple.

the area to be stored on the disk file. All head positioning and drive preparation is taken care of.

LODX and SAVX are the subroutine versions of LODK and SAVK. They require the same data as LODK and SAVK, except that the DTS number must be converted to three single-byte quantities and stored in hexadecimal locations 0000 thru 0002. The subroutine PREP can be used to select the desired drive and seek the desired track. The CVTBIN and CVTDEC subroutines convert the DTS number to binary and decimal, respectively. Subroutine FWDC calculates the next sector in a file. The INITDV subroutine sets the track registers to hexadecimal FF. If any errors are encountered, control is returned to the calling routine with the carry bit set and the error code in the accumulator. This allows complete external control of the disk system.

Since developing KIMDOS, I have developed ZAPDOS. ZAPDOS is modeled after Percom's MINIDOS-PLUSX disk-operating system. It allows loading and saving of up to thirty-one named files per disk. It occupies the upper two read-only-memory sockets in the LFD-400 board. ZAPDOS contains thirteen read-only-memory resident commands to manipulate and display disk space and memory. When used with its ten disk-resident utility programs, ZAPDOS transforms KIM into a powerful microcomputer system.

Conclusion

I have been independent of cassette tape for over two years now. It has been a great pleasure to be able to load even the largest file in 1 or 2 seconds. I no longer leave my KIM system on for days to keep from spending the time necessary to write all of memory to tape and verify that the tape is good. The Percom LFD-400 is a viable and cost-effective answer to the mass-storage problem.

KIMDOS should be easily converted for use on other 6502 systems. An interface for the Apple II should be straightforward. KIMDOS is available in a 2708 read-only memory from Percom. (See below.) I would like to express thanks to Bob Haas for his valuable consultation on this project.■

Percom Data Company (211 North Kirby, Garland TX 75042) is making available the current version of KIMDOS on a 2708 erasable programmable read-only memory (EPROM) part to be used on the disk-controller board of the Percom LFD-400 5-inch floppy-disk drive. This can be obtained along with a Percom LFD-400 disk drive for $15 above the current price of the disk-drive unit. A floppy disk containing KIMDOS-related software (including the ZAPDOS disk-operating system mentioned at the end of this article) is also available from Percom.

BYTE·BYTE·BYTE

BYTE·BYTE·BYTE

LANGUAGES AND TOOLS FOR MICROCOMPUTING: A BYTE CONFERENCE

BYTE·BYTE·BYTE

June 16-17, 1980
McGraw-Hill World Headquarters
New York City

The microcomputer revolution in system design, engineering, and technology is here!

Sophisticated 32 bit computer architectures are appearing in single packages that may be used in a personal computer, a word processor, or even automobile or microwave oven controls. A typical microcomputer-oriented, finished-product design can incorporate total memory, with an address-space utilization of 16K to 64K bytes. With high-volume manufacturing, the total package may cost as little as $100 to $500.

Over the past 25 years there has been a tremendous evolution in the functional capabilities of language systems. These systems need no longer be confined to "big" machines. Much of the improvement in function is becoming available in language systems for microcomputers.

Yet, major manufacturers are still promoting their "super" micro assemblers/debuggers as the best software tool for applications software of computer systems. Consequently, many programmers and designers continue to work with primitive language tools.

This first BYTE-sponsored conference on languages and tools for microcomputing will introduce designers, systems analysts, implementers, and managers to various high level languages and associated systems tools that are becoming commercially available. Knowledge of these recent developments is absolutely essential to productive use of microcomputer techology when that scarce resource, programmer/designer time, is being spread more and more thinly among a myriad of potential applications.

The conference will zero in on five specific high level languages because they are—or shortly will become—readily available for implementations with small computers. Speakers will explore these languages and tools for programming in terms of their usefulness for practical microcomputer applications.

Three of the featured languages are members of a family of languages evolved from FORTRAN by way of Algol: Pascal, C, and Ada. These are most appropriate for uses in which documentation is as much a part of the design philosophy as the achievement of a functional design itself. HAL/S, also in this family, will be discussed at the conference in terms of the history of software tools used in the NASA space-shuttle project's flight-control system design.These languages share purposes with some of the more common commercial languages available on large computers, such as PL/I and COBOL.

Differing in philosophy and point of view—but also commercially available—are two other languages and corresponding language concepts: LISP and FORTH. Each is characterized by a concept of language extensibility, which is implemented in a highly interactive approach. The central and dominant theme of LISP is one of list structures, which may be either data or program material. The concept of tree structures and relationships underlies LISP's usefulness in the artificial-intelligence milieu. FORTH has a central theme of a stack-oriented processor, emulated as a threaded code interpreter, and an extensible library of operations that may be defined beyond a basis set of standard primitives.

THE PROGRAM

Introduction

Carl T. Helmers, Jr.
Editor-in-Chief
BYTE Magazine

Writing in high level languages has numerous well-publicized advantages: programs are more portable; they have superior structures; they are easier to write and debug. At this first session of the conference, Carl Helmers will survey and define language systems, analyze language systems as complete tools, discuss the evolution of all high level languages, and establish reasons why specific high level languages are appropriate for microcomputers.

The Importance of Tools

Dr. Fred H. Martin
Executive Officer
Intermetrics, Inc.

The use of software tools in the development of systems involving computers is crucially important. Fred Martin, one of the designers of the HAL/S language, will review the advantages of high level language techniques and automated aids to programming from the point of view of his NASA experience with HAL/S, developed specifically to replace the machine-dependent, low-level programming that plagued the Apollo project. The crucial importance of high level languages in reliable software design will be reviewed in the context of this system—in which a software crash can literally lead to a pile of broken parts on the ground.

The Pascal Perspective

Peter Grogono
Analyst/Programmer
Concordia University

The Pascal language is one of the most attractive alternatives in the small computer field. It has steadily gained popularity in use on machines as small as the Apple-II. Peter Grogono, the author of Programming in Pascal, will provide an introduction to the language and discuss its use as a more powerful, more modular, more elegant solution to business data problems.

After Pascal, What?

Dr. Kenneth L. Bowles
Director, Institute for Information Systems
University of California, San Diego

While Pascal is an immensely useful language, it is not necessarily a panacea. Limitations of the language in areas of real time control and handling of multiple concurrent processes, in particular, argue for a new look at the design of the language. Ken Bowles will introduce one evolutionary variant that will become very important over the next decade—the Ada language, originally designed for the Department of Defense. Microcomputer implementations of this language, using machine-independent techniques, will make it a strong alternative for programming microcomputer applications systems.

Trees And Lists as Tools

Dr. Henry G. Baker, Jr.
Assistant Professor
University of Rochester

Not all programming problems are amenable to convenient solutions using conventional block-structured, sequential languages. Many require representing complex heterogeneous objects and relationships among those objects. This approach is attractive for selected applications: symbolic mathematical computation, computer-aided design, commercial integrated databases, English front-end processors, computer-aided manufacturing, robotics control, interactive graphic systems, and interactive integrated circuit-design systems.

The LISP language offers the block-structured control of Pascal, together with the friendly interactive nature of BASIC. In addition, it offers lists and trees as data structuring primitives and a tireless "garbage collector" to keep memory neat and clean.

Henry Baker will discuss the LISP language and the kinds of automated tools required to use it.

What is C?

John A. Morse
Principal Engineer, Corporate Research
Digital Equipment Corporation

The language C was originally developed at Western Electric for use as a tool for development of the UNIX operating system at Bell Laboratories. Now that C compilers are starting to become available for microcomputer systems, this language becomes a viable alternative for both operating system and application developers. John Morse will give an overview of the language C and will detail the types of applications for which it is most appropriate.

The Forth Alternatives

Charles H. Moore
Chairman of the Board
Forth, Inc.

One viable and unconventional approach to programming is the highly interactive language FORTH, a language in which the feature of extensibility is emphasized. The typical implementation of FORTH is a highly integrated combination of software development tools and programming aids oriented toward a conceptual stack machine with integers as the primitive data type. In any given application, unique extensions that fit into the matrix basic core of the language are created by the designer. Charles Moore, the inventor of FORTH, will demonstrate some of the more dynamic uses of the language in real-time applications.

BYTE·BYTE·BYTE

BYTE·BYTE·BYTE

LANGUAGES AND TOOLS FOR MICROCOMPUTING: A BYTE CONFERENCE

BYTE·BYTE·BYTE

Who Should Attend

Designers, systems analysts, implementers, and managers with an interest in holding down costs on their software projects. Fields with special applicability include electronics and electronics design, automated manufacturing, scientific instrumentation design, and aerospace control systems.

Circle 110 on inquiry card.

Tentative Schedule

June 16, 1980

8:00- 9:00 A.M.	**REGISTRATION**
9:00-10:00 A.M.	**INTRODUCTION:** Carl Helmers
10:00-10:30 A.M.	**COFFEE INTERMISSION**
10:30-12:00 P.M.	**THE IMPORTANCE OF TOOLS:** Fred Martin
12:00- 1:30 P.M.	**LUNCHEON**
1:30- 3:00 P.M.	**THE PASCAL PERSPECTIVE:** Peter Grogono
3:00- 3:15 P.M.	**COFFEE INTERMISSION**
3:15- 4:45 P.M.	**AFTER PASCAL, WHAT?:** Ken Bowles
4:45- 5:15 P.M.	**OPEN DISCUSSION**

June 17, 1980

8:30-10:00 A.M.	**TREES AND LISTS AS TOOLS:** Henry Baker
10:00-10:30 A.M.	**COFFEE INTERMISSION**
10:30-12:00 P.M.	**THE FORTH ALTERNATIVE:** Charles Moore
12:00- 1:30 P.M.	**LUNCHEON**
1:30- 3:00 P.M.	**WHAT IS C?:** John Morse
3:00- 4:00 P.M.	**PANEL DISCUSSION:** All speakers

To attend the Languages and Tools for Microcomputing Conference, June 16-17, 1980, McGraw-Hill World Headquarters in New York City, fill in the coupon, or write on your company letterhead to:

McGraw-Hill Conference & Exposition Center
1221 Avenue of the Americas
Room 3677
New York, New York 10020
Or call: 212/997-4930

Registration Fee: $485

☐ Payment enclosed (Make check payable to McGraw-Hill Conference & Exposition Center)
☐ Please bill me directly
☐ Please bill company (Payment due prior to Conference)
☐ This confirms my phone reservation

Please Print or Type

NAME ______________________
Last Name   First Name
TITLE ______________________
COMPANY ______________________
ADDRESS ______________________
CITY ______________ STATE ________ ZIP ________
TELEPHONE ( ) ______________
REGISTRANT'S SIGNATURE ______________________
Z

Hotel Reservations: The New York Hilton (212-586-7000) is holding a block of rooms up to three weeks prior to the Conference. For reservations, contact the hotel directly. Please be sure to identify the title and dates of the Conference for preferential treatment.

Cancellation Liability: In the event of cancellation of the Conference for any reason, McGraw-Hill's liability is limited to the return of the registration fee.

Cancellation Policy: Confirmed registrants who cancel within FOURTEEN BUSINESS DAYS of the Conference are subject to a $100 service charge. Cancellation must be received in writing. Confirmed registrants who fail to attend and do not cancel prior to the Conference are liable for the entire registration fee. You may, if you wish, send a substitute.

"WHAT WOULD YOU SAY TO BIG COMPUTER PERFORMANCE FROM YOUR MICROCOMPUTER?"

"YOU'RE TALKING OUR LANGUAGE: PL/I-80.™"

New PL/I-80 from Digital Research Brings Big Computer Programming Power to Microcomputer Systems.

PL/I-80 is the biggest news for small system users and OEMs since we introduced CP/M® and MP/M. PL/I-80 is ANSI's General Purpose Subset of full PL/I, tailored into a language for 8080, 8085 and Z80 users who expect the software revolution they've seen in hardware —better results at lower cost. PL/I-80 works harder than any other general-purpose language for business, science, research and education.

The PL/I-80 software package includes a native code compiler, comprehensive subroutine library, linkage editor and relocating macro assembler. And it's backed by our CP/M and MP/M operating systems.

Best of all, **the complete PL/I-80 system diskette and documentation costs just $500.**

PL/I-80: There's no better way to get big-machine results from your 8-bit processor.

Single-and Multi-User Operating Systems That Set Industry Standards.

CP/M is the industry standard operating system for small machines. With thousands of users throughout the world, it's the most popular and widely used. It's the original, hardware-independent 'bus' for users working with a broad array of languages, word-processing and applications software available from scores of suppliers at affordable prices.

Now we've made a great CP/M even better. CP/M 2.2 is the latest release of the efficient, reliable system that's truly universal, able to manage virtually any 8080, 8085 or Z80 micro and its floppy or hard-disk subsystems. Named to the 1979 Datapro Software Honor Roll, CP/M comes on a diskette with its own operating manual, **for just $150 in unit quantity.**



MP/M provides big-computer power at small-computer cost. It provides multi-terminal access with multi-programming at each terminal. And it's CP/M compatible, so you can run many programming languages, applications packages and development software on your system.

Check these advanced capabilities. Run editors, translators, word processors and background print spoolers simultaneously. Use MP/M's real-time facilities to monitor an assembly line and schedule programs automatically, or control a network of micros. Even write your own system processes for operation under MP/M. The possibilities are endless, **yet MP/M costs just $300 (unit price for diskette and manual).**

Utilities That Work For You.

Use our utilities. Thousands do. They're designed to make your small system work extra hard, yet they cost surprisingly little.:

- MAC™ (Macro Assembler)—$90.
- SID™ (Symbolic Instruction Debugger)—$75.
- ZSID™ (Z80 Symbolic Instruction Debugger)—$100.
- TEX (Text Formatter)—$75.
- DESPOOL™ (Background Print Utility)—$50.

All are supplied on a diskette, with operating manual.

Digital Research
P.O. Box 579
801 Lighthouse Avenue
Pacific Grove, CA 93950
408 649-3896
TWX 910 360 5001

Circle 111 on inquiry card.

DIGITAL RESEARCH

Programming Quickies

Decisions, Decisions

Geoffrey Gass, 5240 SW Dosch Rd, Portland OR 97201

Frequently, a program has to select one of two positive actions as the result of a test (eg: print a "+" or a "−" after checking the sign of a number).

Conventionally, it might be done in a skip chain like this 6800 code:

```
SGN     TST NUMB      Make the test.
        BMI NEG       One course if negative.
        LDA A #'+     The other course if positive.
        BRA PRINT     Watch out — don't run into NEG.
NEG     LDA A#'−      Minus sign for negative number.
PRINT   JSR OUTPUT    Back together again; print the
                      sign.
```

It's awkward, running into yourself like that. Here is how to avoid the awkwardness and save a couple of bytes:

```
SGN     LDA A #'+     Set up for one course in advance.
        TST NUMB      Then make the test.
        BPL PRINT     Confirming advance choice.
        LDA A #'−     Change course if advance choice
                      wrong.
PRINT   JSR OUTPUT    Print the proper sign.
```

The bytes saved (if not otherwise needed) can be used after the TST NUMB to BEQ (branch on accumulator equal to 0) past the PRINT routine if the number is zero, so 0 will be output without a sign, assuming we are dealing with a 1-byte number. ■

Formatted Program Output for the KIM-1

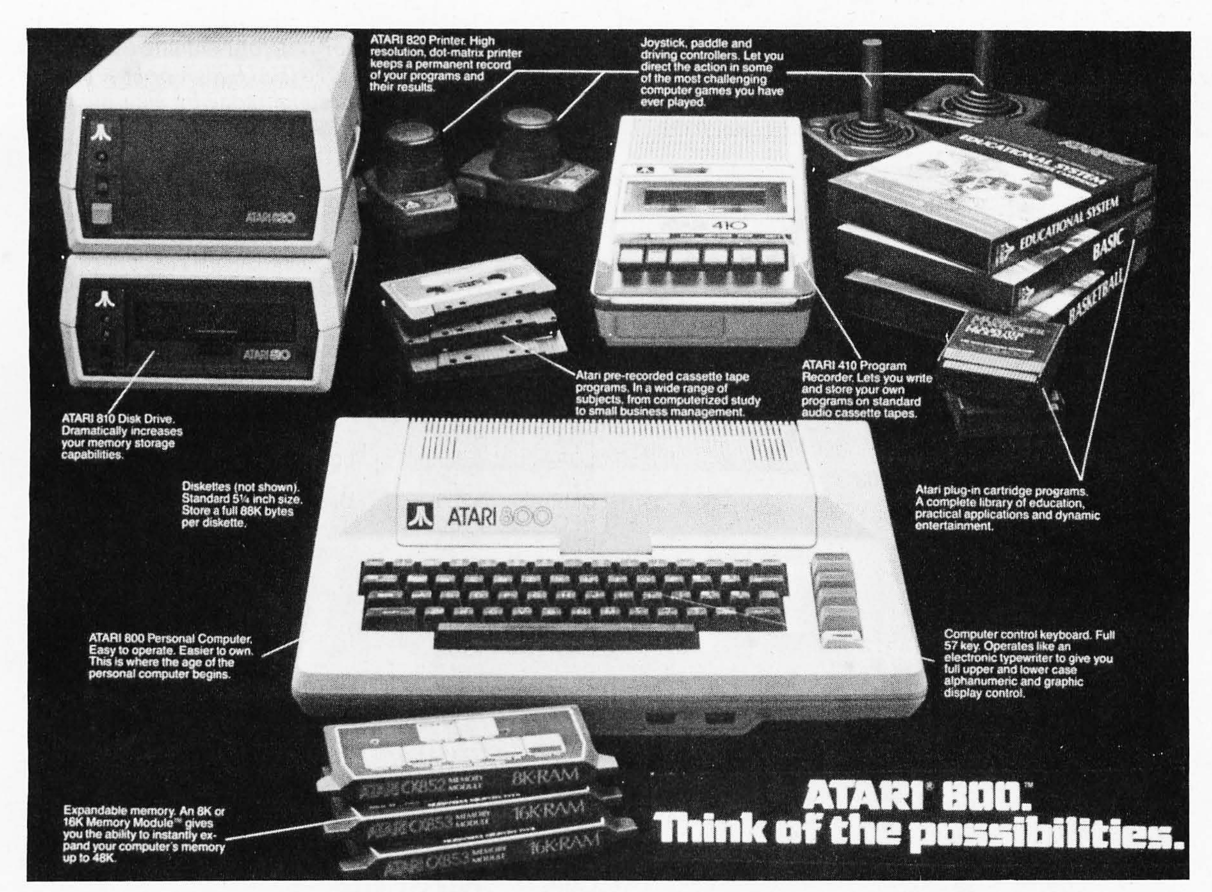
Lawrence A Ezard, PhD, Associate Professor of Engineering, Pennsylvania State University, Capitol Campus, Middletown PA 17057

Here is a short program that might be useful for owners of the MOS Technology KIM-1 system. It can be used to find bugs, and to print out and document programs.

The flowchart in figure 1 illustrates the algorithm utilized. This program will examine the contents of programmable memory and print the program instructions found there. The output is in a format of address, operation code, and operand. The user specifies the starting and stopping addresses to be examined by storing values in the appropriate locations. At the end of its execution, the program returns control to the KIM monitor.

In writing the program, I made use of the fact that, with three exceptions, the least significant digit (in hexa-

MORE COLOR. MORE SOUND. MORE PERSONAL/BUSINESS POWER.



Compare the built-in features of leading microcomputers with the Atari personal computers. And go ahead, compare apples and oranges. Their most expensive against our least expensive: the ATARI® 400™.

Start with graphics capabilities. The ATARI 400 offers 128 color variations. 16 colors in 8 luminance levels. Plus 29 keystroke graphics symbols and 8 graphics modes. All controlled from a full 57 key ASCII keyboard. With upper and lower case. And the system is FCC approved with a built-in RF modulator. That's just for openers.

Now, compare sound capabilities. Four separate sound channels and a built-in speaker. With the optional audio/digital recorder, you can add Atari's unique Talk & Teach™ Educational System cassettes.

Here's the clincher: Solid state (ROM) software. For home management, business and entertainment. Or just plug in an Atari 10K BASIC or Assembler language cartridge and the full power of the computer is in your hands.

Memory? 8K expandable to 16K. And that's just for the ATARI 400 at a suggested retail of only $599.99.

The ATARI® 800™ gives you all that and much more.

User-installable memory to 48K. A full-stroke keyboard.

With a high-speed serial I/O port that allows you to add a whole family of smart peripherals. Including up to four individually accessible disk drives. And a high speed dot-matrix impact printer. And, the Atari Program Recorder is included with the 800 system. Suggested retail price for the ATARI 800 (including recorder) is $999.99.

Make your own comparison wherever personal computers are sold.

Or, send for a free chart that compares the built-in features of the ATARI 400 and 800 to other leading personal computers.

Atari promises to be the most popular Personal Computer System of the 1980's! Feel free to contact us for Atari literature.



NEECO
679 Highland Ave.
Needham, MA
02194

Customer Sales:
NEECO
679 Highland Ave., Needham, MA 02194
(617) 449-1760
Circle 114 for NEECO

Dealer Sales:
Microamerica Distributing
21 Putnum St., Needham, MA 02194
(617) 449-4310
Circle 113 for microamerica

decimal) of 1-byte op codes is always 8 or A. Also, with nine exceptions, the least significant digit of 3-byte op codes is always C, D, or E.

Listing 1 was produced by the program. The labels, source code mnemonics, and comments were added later. The program uses several subroutines from the KIM-1 monitor: CRLF, PRTPNT, OUTSP, PRTBYT, and INCPT.■

Listing 1: *Program in 6502 code to print out hexadecimal instruction codes from KIM-1 memory. Before running the program, do the following. Load the starting address for examination in locations 17F5 (SAL, low-order) and 17F6 (SAH, high-order). Load the ending address plus 1 in locations 17F7 (EAL, low-order) and 17F8 (EAH, high-order). Clear the decimal mode by entering 00 in location 00F1. The starting address for execution is hexadecimal 0301. The memory used is 0300 to 03D0.*

Hexadecimal Address	Hexadecimal Code			Label	Op Code	Operand	Comments
0300				TEMP1			
0301	AD	F5	17		LDA	SAL	Load starting address in POINTL
0304	85	FA			STA	FA	and POINTH
0306	AD	F6	17		LDA	SAH	
0309	85	FB			STA	FB	
030B	20	2F	1E	START1	JSR	CRLF	Do carriage return and line feed
030E	20	1E	1E		JSR	PRTPNT	Print starting address
0311	20	9E	1E		JSR	OUTSP	Print 2 spaces
0314	20	9E	1E		JSR	OUTSP	
0317	A2	00			LDX	#$00	
0319	A1	FA			LDA	(FA,X)	Load Contents of address at FB, FA
031B	8D	00	03		STA	TEMP1	
031E	C9	00			CMP	#$00	Decide if Op Code is 1 byte
0320	F0	15			BEQ	PRNT1	
0322	C9	40			CMP	#$40	
0324	F0	11			BEQ	PRNT1	
0326	C9	60			CMP	#$60	
0328	F0	0D			BEQ	PRNT1	
032A	29	0F			AND	#$0F	
032C	C9	08			CMP	#$08	
032E	F0	07			BEQ	PRNT1	
0330	C9	0A			CMP	0A	
0332	F0	03			BEQ	PRNT1	If not 1 byte
0334	4C	40	03		JMP	B3	Jump to test for 3-byte Op Code
0337	AD	00	03	PRNT1	LDA	TEMP1	Print 1-byte Op Code
033A	20	3B	1E		JSR	PRTBYT	
033D	4C	B7	03		JMP	INCAD	Jump to increment address
0340	AD	00	03	B3	LDA	TEMP1	Test for a 3-byte Op Code
0343	C9	19			CMP	#$19	
0345	F0	31			BEQ	PRNT3	
0347	C9	39			CMP	#$39	
0349	F0	2D			BEQ	PRNT3	
034B	C9	59			CMP	#$59	
034D	F0	29			BEQ	PRNT3	
034F	C9	79			CMP	#$79	
0351	F0	25			BEQ	PRNT3	
0353	C9	99			CMP	#$99	
0355	F0	21			BEQ	PRNT3	
0357	C9	B9			CMP	#$B9	
0359	F0	1D			BEQ	PRNT3	
035B	C9	D9			CMP	#$D9	
035D	F0	19			BEQ	PRNT3	
035F	C9	F9			CMP	#$F9	
0361	F0	15			BEQ	PRNT3	
0363	C9	20			CMP	#$20	
0365	F0	11			BEQ	PRNT3	
0367	29	0F			AND	#$0F	
0369	C9	0C			CMP	OC	
036B	F0	0B			BEQ	PRNT3	
036D	C9	0D			CMP	#$0D	
036F	F0	07			BEQ	PRNT3	
0371	C9	0E			CMP	#$0E	
0373	F0	03			BEQ	PRNT3	
0375	4C	A1	03		JMP	PRNT2	GOTO print 2 bytes
0378	AD	00	03	PRNT3	LDA	TEMP1	Print 3 bytes
037B	20	3B	1E		JSR	PRTBYT	Print Op Code
037E	20	9E	1E		JSR	OUTSP	Space
0381	20	9E	1E		JSR	OUTSP	
0384	20	63	1F		JSR	INCPT	Increment address
0387	A2	00			LDX	#$00	Load contents of address
0389	A1	FA			LDA	(FA,X)	at FBFA
038B	20	3B	1E		JSR	PRTBYT	Print Operand
038E	20	9E	1E		JSR	OUTSP	
0391	20	9E	1E		JSR	OUTSP	
0394	20	63	1F		JSR	INCPT	Increment address
0397	A2	00			LDX	#$00	Load contents of address
0399	A1	FA			LDA	(FA,X)	at FBFA
039B	20	3B	1E		JSR	PRTBYT	Print Operand
039E	4C	B7	03		JMP	INCAD	
03A1	AD	00	03	PRNT2	LDA	TEMP1	Print 2 bytes

Listing 1 continued on page 194



By Netronics

ASCII/BAUDOT, STAND ALONE

Computer Terminal

COMPLETE FOR ONLY . . . $149.95

The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: *1.5 P/P into 75 ohm (EIA RS-170)* • **Baud Rate:** *110 and 300 ASCII* • **Outputs:** *RS232-C or 20 ma. current loop* • **ASCII Character Set:** *128 printable characters—*

αβγδεθιλμνπΣφΨαΩ₀₁₂₃ ⁰²±÷≥≤∫|←→↑↓
!"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{¦}~

BAUDOT Character Set: *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

Netronics R&D Ltd., Dept. PE-9
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

☐ **Netronics Stand Alone ASCII Keyboard/Computer Terminal Kit, $149.95** plus $3.00 postage & handling.
☐ **Deluxe Steel Cabinet** for Netronics Keyboard/Terminal In Blue/Black Finish, **$19.95** plus $2.50 postage and handling.
☐ **Video Display Board Kit** alone (less keyboard), **$89.95** plus $3 postage & handling.
☐ **12" Video Monitor** (10 MHz bandwidth) fully assembled and tested, **$139.95** plus $5 postage and handling.
☐ **RF Modulator Kit** (to use your TV set for a monitor), **$8.95** postpaid.
☐ **5 amp Power Supply Kit** In Deluxe Steel Cabinet (±8VDC @ 5 amps, plus 6-8 VAC), **$39.95** plus $2 postage & handling.

Total Enclosed (Conn. res. add sales tax) $______ By—
☐ Personal Check ☐ Cashiers Check/Money Order
☐ **Visa** ☐ **Master Charge** (Bank # ____)
Acct. # ______
Signature ______ Exp. Date ______
Print Name ______
Address ______
City ______
State ______ Zip ______
☐ **Send Me More Information**

Start Computing For Just $129.95 With An 8085-Based Professional Computer Kit—

Explorer/85

100% compatible with all 8080A and 8085 software & development tools!

No matter what your future computing plans may be, Level "A"—at $129.95—is your starting point.

Starting at just $129.95 for a Level "A" operating system, you can now build the exact computer you want. Explorer/85 can be your beginner's system, OEM controller, or IBM-formatted 8" disk small business system...yet you're never forced to spend a penny for a component or feature you don't want and you can expand in small, affordable steps!

Now, for just $129.95, you can own the first level of a fully expandable computer with professional capabilities—a computer which features the advanced Intel 8085 cpu, *thereby giving you immediate access to all software and development tools that exist for both the 8085 and its 8080A predecessor (they are 100% software compatible)*—a computer which features onboard S-100 bus expansion—plus instant conversion to mass storage disk memory with either 5-1/4" diskettes or standard IBM-formatted 8" disks.

For just $129.95 (plus the cost of a power supply, keyboard/terminal and RF modulator, if you don't have them already), Explorer/85 lets you begin *computing* on a significant level... *applying* the principles discussed in leading computer magazines...*developing* "state of the art" computer solutions for both the industrial and leisure environment.

Level "A" Specifications

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an 8155 ROM-I/O—all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, *plus* generous prototyping space.

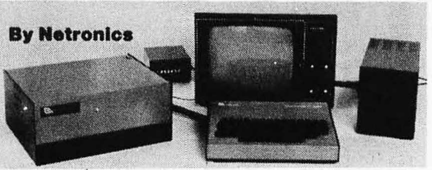
(Level "A" makes a perfect OEM controller for industrial applications and is available in a special Hex Version which can be programmed using the Netronics Hex Keypad/Display.)

Level "A" at $129.95 is a complete operating system, perfect for beginners, hobbiests, or industrial controller use.

PC Board: glass epoxy, plated through holes with solder mask • **I/O:** provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader ...provision for 24-pin DIP socket for hex keyboard/display...cassette tape recorder input...cassette tape recorder output...cassette tape control output...speaker output... LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit plus one 6-bit I/O ports • **Crystal Frequency:** 6.144 MHz • **Control Switches:** reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • **Counter/Timer:** programmable, 14-bit binary • **System RAM:** 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F000 leaving 0000 free for user RAM/ROM. Features include tape load with labeling ...tape dump with labeling...examine/change contents of memory ...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address... move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory ...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling... tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point ...go to execution address. Level "A" in the *Hex Version* makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.



Hex Keypad/Display Specifications



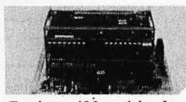
Hex Keypad/Display.

Calculator type keypad with 24 system defined and 16 user defined keys. 6 digit calculator type display which displays full address plus data as well as register and status information.

Level "B" Specifications

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks...address decoding for onboard 8k EPROM expansion selectable in 8k blocks...address and data bus drivers for onboard expansion...wait state generator (jumper selectable), to allow the use of slower memories...two separate 5 volt regulators.

Level "C" Specifications



Explorer/85 with Level "C" card cage.

Level "C" expands Explorer's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and cards are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors

Level "D" Specifications

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to EFFF in 4k blocks.

Level "E" Specifications

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of onboard RAM).

Order A Coordinated Explorer/85 Applications Pak!

Experimenter's Pak (SAVE $12.50)—Buy Level "A" and Hex Keypad/Display for **$199.90** and get FREE Intel 8085 user's manual plus FREE postage & handling!

Student Pak (SAVE $24.45)—Buy Level "A," ASCII Keyboard/Computer Terminal, and Power Supply for **$319.85** and get FREE RF Modulator plus FREE Intel 8085 user's manual plus FREE postage & handling!

Engineering Pak (SAVE $41.00)—Buy Levels "A," "B," "C," "D," and "E" with Power Supply, ASCII Keyboard/Computer Terminal, and six S-100 Bus Connectors for **$514.75** and get 10 FREE computer grade cassette tapes plus FREE 8085 user's manual plus FREE postage & handling!

Business Pak (SAVE $89.95)—Buy Explorer/85 Levels "A," "B," and "C" (with cabinet), Power Supply, ASCII Keyboard/Computer Terminal (with cabinet), 16k RAM, 12" Video Monitor, North Star 5-1/4" Disk Drive (includes North Star BASIC) with power supply and cabinet, all for just **$1599.40** and get 10 FREE 5-1/4" minidiskettes ($49.95 value) plus FREE 8085 user's manual plus FREE postage & handling!

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

Netronics R&D Ltd., Dept. RE 10
333 Litchfield Road, New Milford, CT 06676

Please send the items checked below—

☐ **Explorer/85 Level "A" Kit** (ASCII Version), **$129.95** plus $3 p&h.
☐ **Explorer/85 Level "A" Kit** (Hex Version), **$129.95** plus $3 p&h.
☐ **8k Microsoft BASIC** on cassette tape, **$64.95** postpaid.
☐ **8k Microsoft BASIC in ROM Kit** (requires Levels "B," "D," and "E"), **$99.95** plus $2 p&h.
☐ **Level "B" (S-100) Kit, $49.95** plus $2 p&h.
☐ **Level "C" (S-100 6-card expander) Kit, $39.95** plus $2 p&h.
☐ **Level "D" (4k RAM) Kit, $69.95** plus $2 p&h.
☐ **Level "E" (EPROM/ROM) Kit, $5.95** plus 50¢ p&h.
☐ **Deluxe Steel Cabinet** for Explorer/85, **$49.95** plus $3 p&h.
☐ **ASCII Keyboard/Computer Terminal Kit** (features a full 128 character set, upper & lower case, full cursor control, 75 ohm video output convertible to baudot output, selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator), **$149.95** plus $2.50 p&h.
☐ **Hex Keypad/Display Kit, $69.95** plus $2 p&h.
☐ **Deluxe Steel Cabinet** for ASCII Keyboard/Terminal, **$19.95** plus $2.50 p&h.
☐ **Power Supply Kit** (±8V @ 5 amps) in deluxe steel cabinet, **$39.95** plus $2 p&h.
☐ **Gold Plated S-100 Bus Connectors, $4.85** each, postpaid.
☐ **RF Modulator Kit** (allows you to use your TV set as a monitor), **$8.95** postpaid.
☐ **16k RAM Kit** (S-100 Board expands to 64k), **$199.95** plus $2 p&h.
☐ **32k RAM Kit, $329.95** plus $2 p&h.
☐ **48K RAM Kit, $459.95** plus $2 p&h.
☐ **64k RAM Kit, $589.95** plus $2 p&h.
☐ **16k RAM Expansion Kit** (to expand any of the above up to 64k), **$139.95** plus $2 p&h each.
☐ **Intel 8085 cpu User's Manual, $7.50** postpaid.
☐ **Special Computer Grade Cassette Tapes, $1.90** each or **3 for $5**, postpaid.
☐ **12" Video Monitor** (10 MHz bandwidth), **$139.95** plus $5 p&h.
☐ **North Star Double Density Floppy Disk Kit** (One Drive) for Explorer/85 (includes 3 drive S-100 controller, DOS, and extended BASIC with personalized disk operating system—just plug it in and you're up and running!), **$699.95** plus $5 p&h.
☐ **Power Supply Kit** for North Star Disk Drive, **$39.95** plus $2 p&h.
☐ **Deluxe Case** for North Star Disk Drive, **$39.95** plus $2 p&h.
☐ **Experimenter's Pak** (see above), **$199.90** postpaid.
☐ **Student Pak** (see above), **$319.85** postpaid.
☐ **Engineering Pak** (see above), **$514.75** postpaid.
☐ **Business Pak** (see above), **$1599.40** postpaid.

Total Enclosed $ ______ (Conn. res. add sales tax) By—
☐ Personal Check ☐ M.O./Cashier's Check ☐ Visa ☐ Master Charge (Bank # ____)
Acct. # ______
Signature ______ Exp. Date ______
Print Name ______
Address ______
City ______
State ______ Zip ______
☐ **Send Me Information**

Circle 115 on inquiry card.

Circle 116 on inquiry card.

Listing 1 continued:

```
03A4  20  3B  1E         JSR  PRTBYT   Print Op Code
03A7  20  9E  1E         JSR  OUTSP    Space
03AA  20  9E  1E         JSR  OUTSP
03AD  20  63  1F         JSR  INCPT    Increment address
03B0  A2  00             LDX  #$00     Load contents of
03B2  A1  FA             LDA  (FA,X)   address at FBFA
03B4  20  3B  1E         JSR  PRTBYT   Print Operand
03B7  20  63  1F  INCAD  JSR  INCPT    Increment to next Op Code
03BA  A5  FB             LDA  FB       Address
03BC  CD  F8  17         CMP  EAH
03BF  F0  03             BEQ  NEXT
03C1  4C  0B  03         JMP  START1   If this address is
03C4  A5  FA      NEXT   LDA  FA       equal to the ending
03C6  CD  F7  17         CMP  EAL      address then stop
03C9  F0  03             BEQ  STOP     Otherwise go to START1
03CB  4C  0B  03         JMP  START1   and print the Op Code
03CE  4C  4F  1C  STOP   JMP  START
```

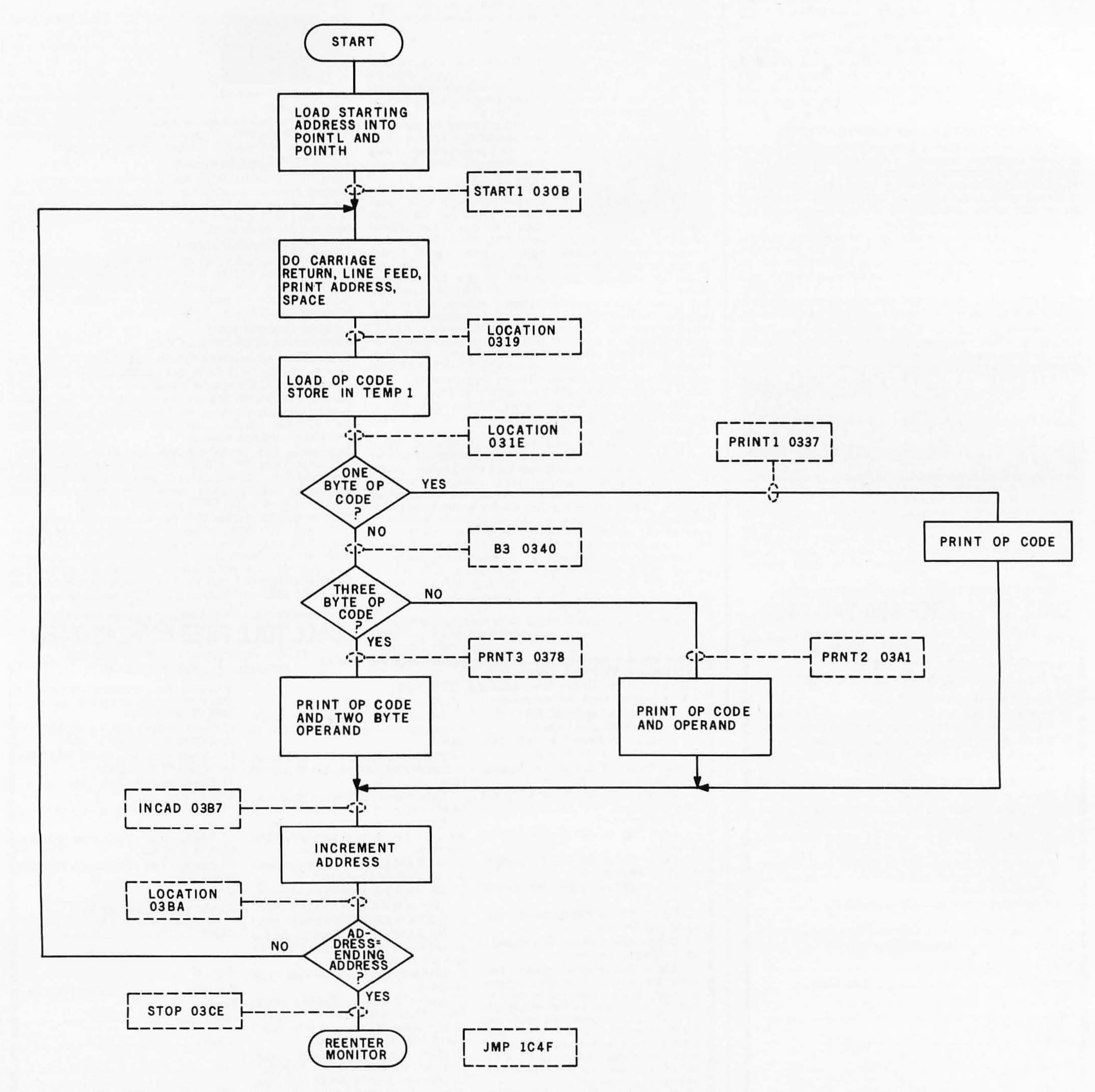


Figure 1: *Flowchart of procedure used to print hexadecimal instruction codes from KIM-1 memory.*

Until now, computer graphics suffered from terminal high cost.

If you've ever considered displaying Tektronix* graphics data from a host computer, you know all about terminal high cost. A hunk of hardware like a Tektronix 4010 graphics terminal can set you back quite a few kilobucks. It's enough to drive a person of modest means to the drafting table.

The Affordable Alternative

ABW Corporation has just made graphics display as practical as the personal computer. With TEKSIM. The Apple II/Tektronix 4010 Simulator. TEKSIM is a read-only memory (ROM) that plugs directly into an inexpensive Apple II* computer. Combining an advanced programming technique known as *distributed processing* with Apple's high resolution plotting capabilities enables TEKSIM to emulate Tektronix 4010-series terminals at a fraction of the cost. (A symbolic representation of TEKSIM *in operation* is provided below for the technically minded.)

Outstanding Features

The TEKSIM-Apple combination functions in the same way as a Tektronix terminal, displaying graphical output from a host computer *without any modification to the host-resident program.* You can also input data to the host using game paddles or a joystick. And a TEKSIM-Apple terminal even has features not available in the 4010-series. Six-color "palette" for multicolored displays. Selective erase. Video output to allow any size television to serve as the screen. Plus the added benefits of a powerful Apple II computer to use both in and out of graphics mode. Any compromise? Just one. Apple's resolution is about a fourth that of a Tektronix terminal. Still more than adequate for most applications.

Best Buy for Business; Education

TEKSIM is the logical choice for corporations and educators. A Tektronix terminal can be too much for a limited budget. And investing in TEKSIM-Apple terminals will make any budget—big or small—go a lot further.

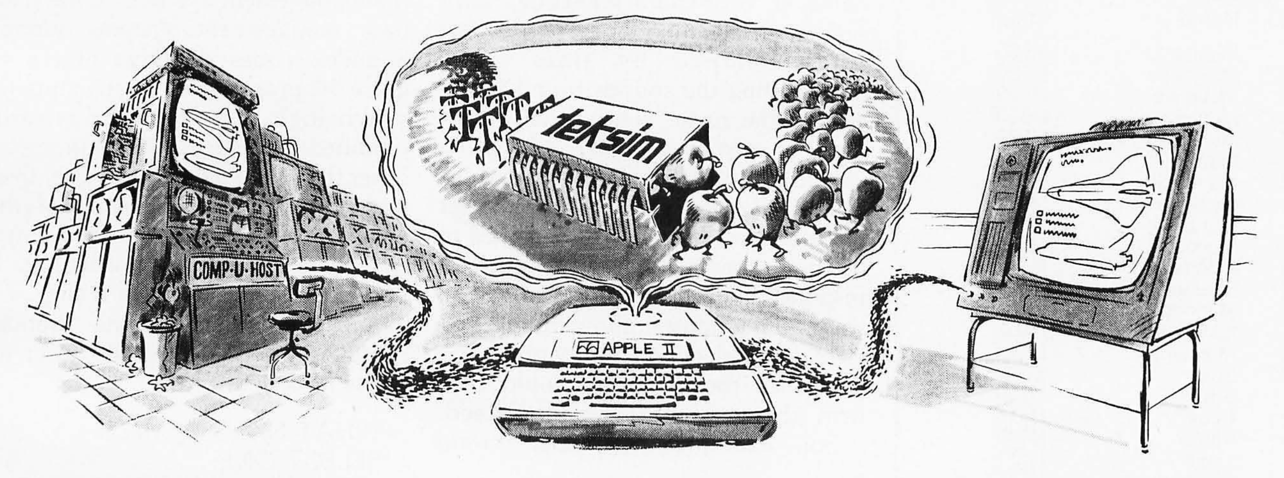
Exceptional performance. Affordable price. That's TEKSIM, from ABW. At $795†, TEKSIM marks the end of terminal high cost.

For more TEKSIM information, mail this coupon to:
ABW Corporation
P.O. Box M 1047
Ann Arbor, MI 48106

Or call (313) 971-9364.

Name________
Position________
Company________
Address________
City____ State____ Zip____
Please contact me. Phone________

Dealer inquiries invited. 10050



Here's how TEKSIM works: First, Tektronix data comes out of the host computer. *Then TEKSIM transforms it into Apple data...* *...so it can be displayed on the Apple's TV screen.*



APPLE II/TEKTRONIX 4010 SIMULATOR

ABW CORPORATION

Circle 117 on inquiry card.

Give Your Computer an Ear for Names

Tom Munnecke
c/o Metasystems
6199 Shaker Dr
Riverside CA 92506

One of the major criticisms of the computer is that it is too literal (ie: unable to accept minor errors from fallible human operators). When the computer asks a question, if an answer is not *exactly* right the computer rejects it, even if the answer was *nearly* correct. The computer does not apply a human's reasoning ability to determine the intent of the operator. Instead, it works only with the exact response.

There is a technique which has been used since the turn of the twentieth century to retrieve names based on pronunciation, rather than their spelling. It is called the Soundex code, and was originally developed to search for names in the 1890 census files. The technique is to give each name a four-character code, consisting of the first letter of the last name followed by three digits representing the sounds found in the rest of the name. This code is then used to group together all names which "sound like" each other.

The Soundex code allows the user to enter a name in a form believed to be the proper spelling. The computer responds with a menu listing all sound-alike names, allowing the user to make a selection. If only one name is found, the computer could confirm the name identity and proceed.

For example the user could misspell "Gonzales" as "Gonzalez"; "Smythe" as "Smith"; or "Andersen" as "Anderson." I am particularly sensitive to this problem because my name (loosely pronounced "money-key") is regularly misspelled. Table 1 shows a sample of the misspellings, as collected from actual mail I have received during the last two years.

Name	Code
Munnecke	M520
Minnecke	M520
Munnuke	M520
Munneake	M520
Munneeke	M520
Municky	M520
Muneeck	M520
Monkey	M520
Muneick	M520
Munnick	M520
Monnecks	M521
Muuncake	M522
Munnedie	M530
Lunnecke	L520
Munnecle	M524
Euler	E460
Gauss	G200
Hilbert	H416
Knuth	K530
Lloyd	L300
Lukasiewicz	L222
Smith	S530
Smyth	S530
Smythe	S530
Smitty	S530
Gonzales	G524
Gonzalez	G524

Table 1: *Sample Soundex code for several names. The first fourteen names following the author's are misspellings of his name, actually found on mail, along with their respective Soundex codes. Notice that most of the misspellings reduce to the same Soundex code and could identify the correct name.*

Letters	Code Digit
b,f,p,v	1
c,g,j,k,s,x,z	2
d,t	3
l	4
m,n	5
r	6

Table 2: *Numeric single-digit codes that are assigned to letters from the corresponding groups as they occur in a name being encoded in the Soundex system.*

The exact use of the Soundex code varies greatly with the computer's file-management system. Some database management systems support Soundex codes directly; others require the programmer to structure the search logic. The program is easily modified to arrange sounds in groups other than as shown. Therefore, there are many modified versions of this technique in use around the country to account for local variations in names and programmer's whims.

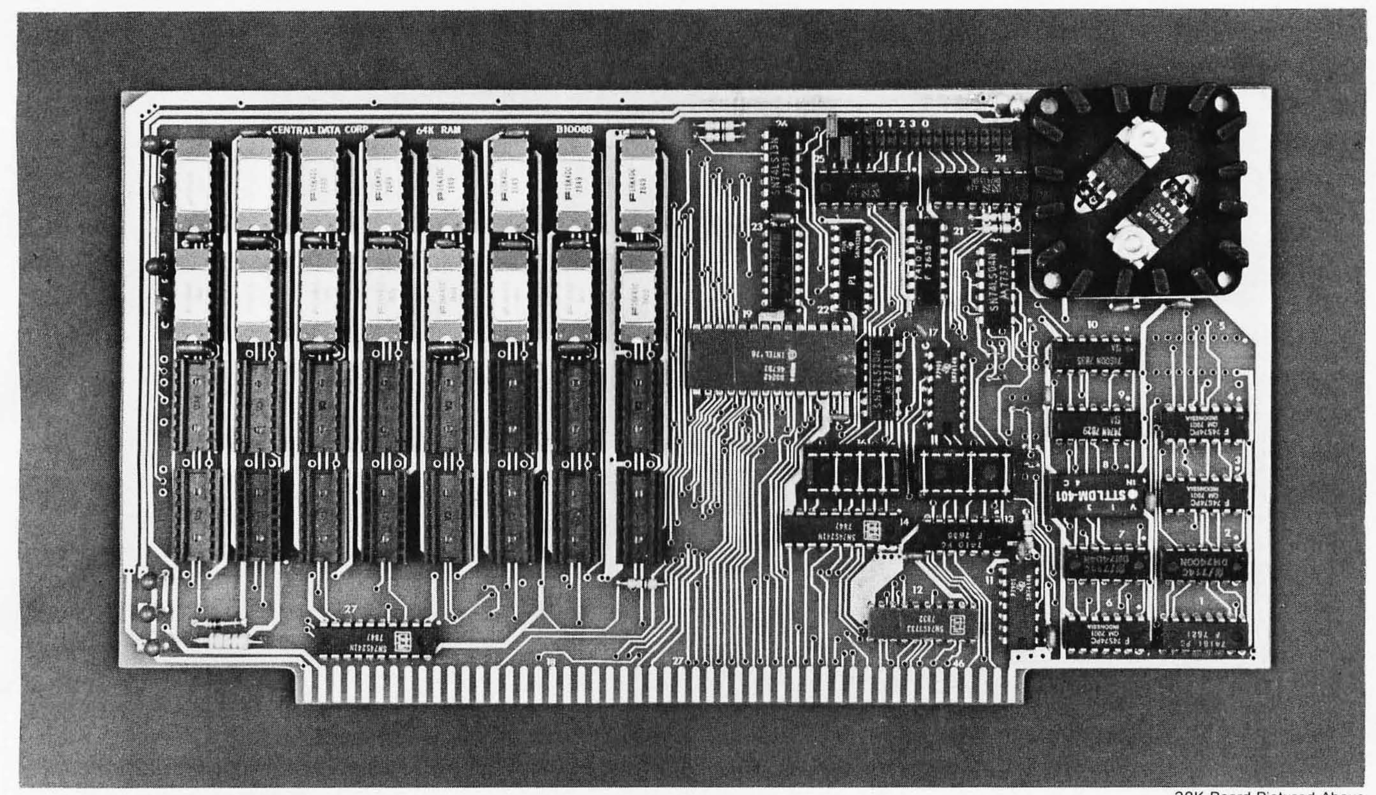
The user might see the Soundex routine working as follows (user input is italicized):

WHAT NAME: *SMITH*
SELECT ONE:
1. Smith, Jack 123 Main St
2. Smith, John 456 Central St
3. Smythe, Zachary 789 First Ave
Enter Choice:________

If there is only one name with the sound, the computer might respond:

WHAT NAME: *SMITH*
John Smith, 123 Main St

This approach is only the most simple technique. It can be enhanced by adding the first initial of the first name, sex, birthdate, or other characteristic



32K Board Pictured Above

Why Not the Best?

From The Dynamic RAM Company.

	2MHz	4MHz
16K	$249	$259
32K	$375	$395
48K	$500	$530
64K	$625	$665

We have now been shipping our 2MHz dynamic RAM boards for over two years. Hundreds of 4MHz boards have been going out every month since early 1979. Our reliability is proven in the thousands of systems which contain our board. Many quality-minded systems houses across the country and overseas are using our boards for their equipment.

Our prices still beat all. Despite rising 16K memory chip prices (at least from reputable suppliers), Central Data continues to give you the best buy in memory today. Nobody offers a board with a capacity of 64K, assembled, tested, and guaranteed for a full year at the price we do.

Deselect around PROMs. Our boards have the important deselect feature which lets you overlap any fixed memory in your system with no interference.

Our features make the board easily used and expanded. You address our boards on 16K boundaries with mini-jumps (small shorting plugs that slide over wire-wrap pins) near the top of the board for easy access. If you want to expand your board after you have purchased it, all that you need to do is add memory. We can supply you with expansion packages ($150-2MHz, $160-4MHz) which include eight RAMs that you can depend on as well as two mini-jumps for addressing. And of course, our board **never** generates wait states.

Low power consumption keeps your computer running cool and reliable. The total power consumption of our 16K board is typically less than 4 watts (+8V @ 300ma, +16V @ 150ma and −16V @ 20ma). Boards with additional memory typically increase power consumption only 1 watt per 16K!

Standard S-100 Interface. Our board is designed to interface with any standard S-100 CPU. All of the timing of the board is independent of the processor chip, and the board is set up for different processors by changing two plugs on the board.

Call or write us today. That will guarantee a fast response with more information on the board. Or make an order — you'll probably have the board in two weeks! **If you're interested, also ask for a catalog on our Z8000 16-bit processor board designed for the MULTIBUS.** All of these products are available to your local dealer, also.

Central Data Corporation, 713 Edgebrook Drive, PO Box 2530, Station A, Champaign, IL 61820. (217) 359-8010

Central Data

Circle 118 on inquiry card

Listing 1: *Soundex program written in Microsoft BASIC for the Commodore PET. Table 3 describes variables used in the program.*

```
100     REM TEST DRIVER FOR SOUNDEX
110     INPUT "LAST NAME":N$
120     GOSUB 2000:REM EXECUTE SUBROUTINE
130     PRINT "SOUNDEX CODE =";S$
140     GOTO 100
2000    REM SOUNDEX ROUTINE TOM MUNNECKE 2/22/79
2010    REM RETURNS SOUNDEX CODE S$ FROM LAST NAME N$
2020    REM SEE KNUTH, "ART OF COMPUTER PROGRAMMING", VOL #3, P 391
2030    REM L$="  ": REM LAST SOUND
2040    S$=MID$(N$,1,1):REM START WITH FIRST LETTER OF NAME
2050    IF LEN(N$) < 2 THEN 2200:REM SKIP SHORT NAMES
2060    FOR I = 2 TO LEN (N$):REM FOR EACH REMAINING LETTER
2070    E$=MID$(N$,I,1):REM SELECT I-TH LETTER
2080    E=ASC(E$)-64:REM CONVERT A THRU Z TO NUMBER 1 THRU 26
2090    IF E > 26 OR E < 1 THEN 2160:REM USE ONLY LETTERS
2095    REM SELECT SOUNDEX CODE
2100    K$=MID$("0 1 2 3 0 1 2 0 0 2 2 4 5 5 0 1 2 6 2 3 0 1 0 2 0 2",E,1)
2110    REM       A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
2120    IF K$=L$ OR K$="0" THEN 2160:REM SKIP TWO CONTIGUOUS SOUND-ALIKES
2140    S$=S$+K$:REM BUILD UP SOUNDEX RESULT
2150    IF LEN(S$)> 3 THEN 2200:REM ONLY FIRST 4 SOUNDS
2160    L$=K$:REM SAVE LAST SOUND
2170    NEXT:REM DO NEXT CHARACTER IN NAME
2200    S$=LEFT$(S$+"000",4):REM PAD TO RIGHT WITH ZEROS AND SHORTEN TO 4 CHARS
2210    RETURN
2999    END
```

to identify the person with greater accuracy.

Constructing the Soundex Code

The technique for constructing the Soundex code is found on page 391 of *The Art of Computer Programming, Volume 3: Sorting and Searching* by Donald Knuth (published by Addison-Wesley, Reading MA). The four steps in generating a Soundex code are:

1. Retain the first letter of the name, and drop all occurrences of a,e,i,o,u,w,y,h and q in other positions.
2. Assign *group numbers* to the remaining letters after the first according to the scheme given in table 2.
3. If two or more letters with the same code are adjacent in the original form of the name

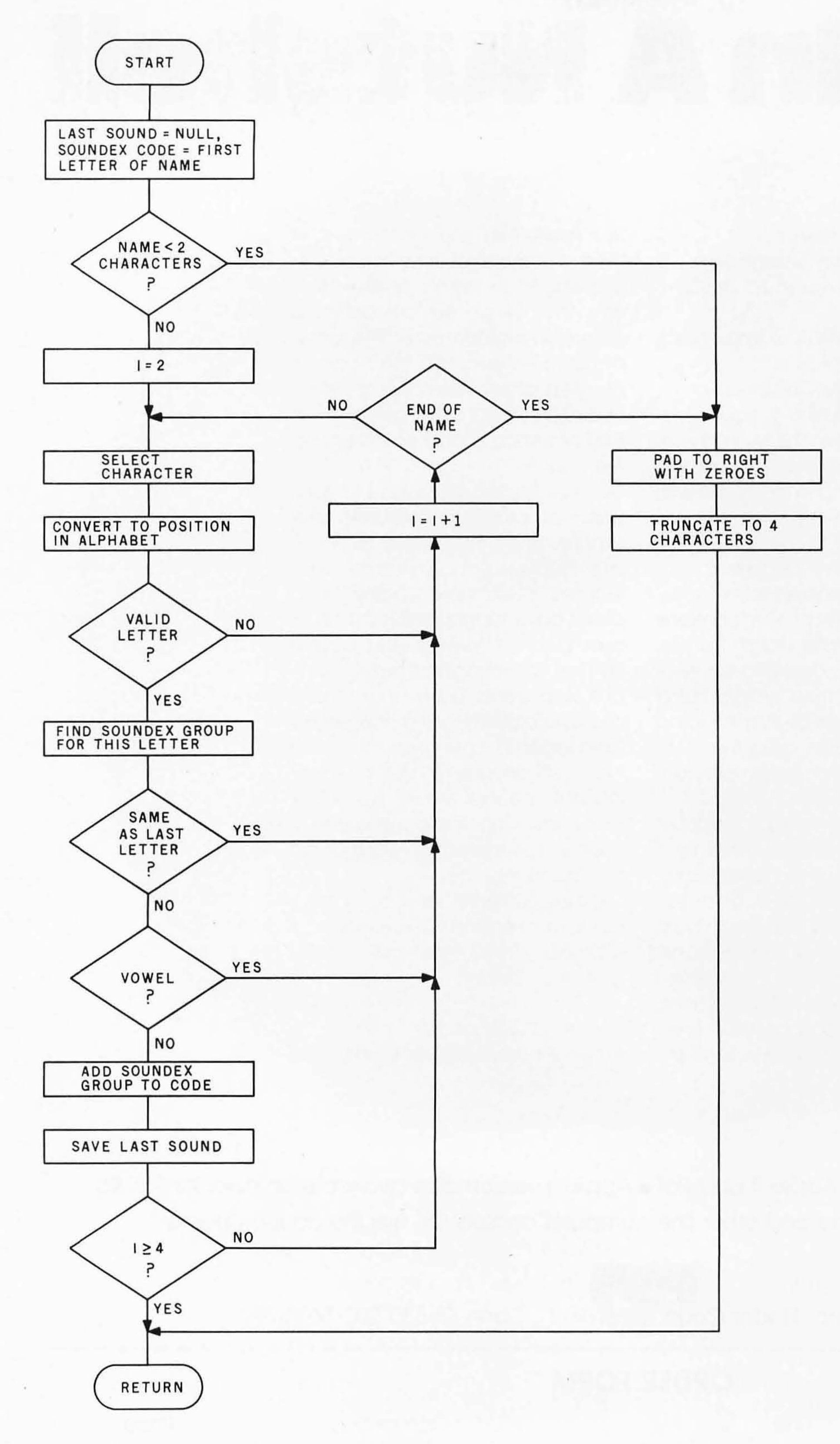


Figure 1: *Flowchart of the Soundex algorithm subroutine.*

Input		
N$	—	Name to be coded
Output		
S$	—	Soundex code of N$ (form: letter,digit,digit,digit)
Temporary		
I	—	Character position in N$ under consideration
E$	—	Ith Character in N$
E	—	Alphabetic sequence of E$
L$	—	Last sound during evaluation

Table 3: *Variables used in the Soundex program.*

(before step 1), omit all but the first.

4. Convert the name to the form *letter, digit, digit, digit* by adding trailing zeroes (if there are less than three digits), or by dropping rightmost digits, if there are more than three.

BASIC Program

Listing 1 shows the Soundex code generating subprogram that constructs the encoded form from a last name. It was written and tested on a Commodore PET 2001 computer, but it should work on any computer using Microsoft BASIC. It should work on other BASICs which have LEFT$, RIGHT$, and MID$ functions, and use "+" for string concatenation.

Figure 1 shows the flowchart describing the program's operation. Line numbers on the flowchart correspond to the BASIC line numbers in listing 1. The program is separated into two parts: the Soundex routine, starting at line 2000, and a test driver starting at line 100. The driver is used to ask for a name, invoke the Soundex generator, then print the results. It will be replaced by your program logic for filing and retrieving. The Soundex generator in line 2000 accepts as input the variable N$, representing the last name to be converted. It returns S$, the Soundex code for N$.

The only tricky part of the program is contained between lines 2080 and 2110. Instead of testing each letter individually, as shown in the original technique above, the program converts the letter to a number from 1 to 26, representing its position in the alphabet. It then uses this number to index a character string, containing the group codes for each letter. The comment below the index line at line 2110 documents this technique, and provides a reference in case the codes need to be changed.

The Soundex subroutine may be incorporated into programs that require the computer to understand user input. The addition of a Soundex routine can increase the usefulness of a computer. ■

TIME after TIME



BATTERY SUPPORTED CALENDAR CLOCKS

PDP-11*

TCU-100 • $495
- Provides month, day, hour, minute and second.
- Can interrupt on date/time, or periodic intervals.

TCU-150 • $460
- Provides year, month, day, hour, minute and second.
- Automatic leap year.
- Patches for RSX-11M, RT-11 FB/SJ VO2, VO3 and UNIX.

LSI-11/2*

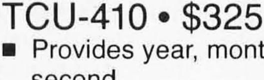
TCU-50D • $325
- Provides month, day, hour, minute and second.
- Dual size board.
- Patches for RT-11 SJ/FB VO2, VO3B.

Lockheed SUE

TCU-200 • $550
- Provides year, month, day, hour, minute, second and milli-second.
- Interval interrupts between 1/1024 seconds and 64 seconds.

Computer Automation (Naked Mini)

TCU-310 • $385
- Provides year, month, day, hour, minute and second.



Multi-Bus**

TCU-410 • $325
- Provides year, month, day, hour, minute and second.
- SBC/BLC compatible.

HP 2100

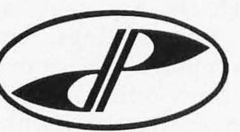
TCU-2100 • $395
- Correct time restored after power failure.
- Compatible with the HP TBG card.

Serial Clock (RS 232 or 20 mA)

SLC-1 • $640
- Connects between any terminal and host computer.
- Provides date, time and more!

All Digital Pathways TCUs have on board NICAD batteries to maintain time and date during power down. Timing is provided by a crystal controlled oscillator. Prices are U.S. domestic single piece. Quantity discounts available.

For more information on these products, contact:
Digital Pathways Inc.
4151 Middlefield Road
Palo Alto, CA 94306
Phone: (415) 493-5544



**Trademark of Digital Equipment Corporation*
***Trademark of Intel Corporation*
****Trademark of Computer Automation Incorporated*

DIGITAL PATHWAYS

Circle 120 on inquiry card.

The Club Computer Network

Joe Kasser
11532 Stewart Ln
Silver Spring MD 20904

Does a club need a computer network? What are its uses? What are the advantages of having such a network?

This article attempts to answer these questions and provide ideas on the techniques used in implementing the network.

Basic Communications Needs

An important aspect of any hobby is communication. The sharing of information and experiences can add a great deal of enjoyment and save much time. If the techniques used to solve some problem are made available by the solvers to others, the recipients of the solution can advance the state of the art. This is done by building upon the foundations developed by the original solvers, rather than by rebuilding the same foundations.

In the computer field, communications fall into two similar but distinct categories: the exchange of personal messages and the exchange of computer data (programs or data bases).

Personal messages may contain any plain language text. Computer data may contain programs, data bases, and instructions for processing files.

About the Author

Joe Kasser is vice-president of the Chesapeake Microcomputer Club, director of information and publicity of the Radio Amateur Satellite Corp (AMSAT), and editor of ORBIT. *He has worked with microcomputers professionally since 1975, and has built an 8080-based, S-100 computer system which served as the prototype for the club's construction project. He has contributed other articles to BYTE, including "AMSAT 8080 Standard Debug Monitor" (September 1976, page 108, with Richard C Allen), "The Sky's the Limit" (November 1978, page 48) and "The AMSAT-GOLEM-80" (September 1979, page 182).*

Computer data comes in many forms. In the personal computer area, data may be on paper tape, cassette tape, or floppy disk. If it is on cassette, it may be in a digital saturation format or some modulated audio format. It may also be recorded at one of several data rates.

If data is on a floppy disk, the disk may be soft-sectored or hard-sectored. Data may be on 5- or 8-inch disks, which may be single or double density, single or double sided. The disk format may be compatible to a disk operating system such as CP/M or North Star, or it may not.

Most computer users do not have the means for reading or writing all of the different types of off-line storage media. Thus, two users who wish to share software may have what is known as a "media incompatibility problem."

A typical example occurs in the Chesapeake Microcomputer Club (CMC). Two members own 8080 or Z80-based systems, each running the Digital Research CP/M disk operating system. One member, however, uses 8-inch soft-sectored disks, while the other uses a North Star system (5-inch hard-sectored disks). They have no compatible medium such as tape. How then are they to share computer files?

The club is spread out over a wide geographic area. Several of the officers require access to the club roster or membership list. Currently the list is kept by one officer who has to update it, see that labels are printed for mailings, and send physical copies of the list to the other officers. Since officers may live 30 to 50 miles apart, the telephone and postal services are the only practical method for information exchange. There must be a better way.

The club has a need for disseminating information. Reports concerning main meetings, chapter meetings, group purchases, surplus information, and special interest groups have to be made available to the membership. Currently the information is passed out at meetings and through the mails by a monthly newsletter. Is there a better way?

Many of the members possess their own computer systems. The degree of sophistication ranges from a simple KIM-1 to a system with dual disk drive, large amounts of memory, and line printers. A number of members have become involved with the club computer project and the group-purchase plan for equipment. Each one of these systems is in a different stage of development. Many people are finding that their system cannot perform the tasks that they wish it to perform, because several system components (such as extra memory or disk storage capability) are lacking for one reason or another. Perhaps the capital outlay involved is not available, or they are waiting for deliveries to take place.

When contemplating the purchase of additional hardware and software, decisions involving hundreds of dollars must be made, sometimes with little factual information. At club meetings members can discuss their requirements and experiences, but that just results in acquisition of information about how a particular item of computerware works in someone else's environment and how it meets *his* requirements.

It would be nice to be able to get together with a friend and gain hands-on experience of the way that a computer system component performs in one's own environment before purchasing it. Visiting friends

BALTIMORE

RANDALLSTOWN

LAUREL

SILVER SPRING

WASHINGTON DC

McLEAN

○ = COMPUTER
X = PHONE USER
□ = RADIO USER (HAM)
☒ = PHONE/RADIO USER (HAM)
——— = TELEPHONE LINK
– – – = RADIO LINK

Figure 1: *Diagram of sample telephone and radio-data transmission links in a typical club computer network. Several computers form nodes in the network. Solid lines indicate telephone links; dotted lines indicate links through a 2-meter band amateur radio repeater system (at the same location as one of the computers). Communities identified are located in northern Virginia and in Maryland (except for Washington DC).*

and using their systems can provide this facility, but it is inconvenient, especially when a long session is planned or the traveling distance is great. There must be a better way.

Basic Network

There *is* a better way. It is called *a club computer network*. All club members can have access to it. It may be centralized or distributed, but it will provide a service to the club members. Access may be via the telephone line or via amateur radio-teletypewriter (RTTY) circuits. Each access method has its own advantages and disadvantages.

An example of such a network is shown in figure 1. It incorporates both radio and telephone links. It also allows for a number of computers in the system. It is spread out over a

relatively wide geographic area. One computer may be accessed either via a 2-meter FM radio-teletypewriter repeater (operated by the Amateur Radio Development Association, AMRAD, using the frequencies 147.81 and 147.21 MHz), or via the telephone line. The other computers are operated on behalf of the Chesapeake Microcomputer Club Inc by various members. Note that this area-wide operation is necessitated by the geographic dispersal of the membership of the two clubs.

The central computers are located so that at least one computer is within local telephone-dialing range of each club member. Several members may be within local dialing range of more than one. If one machine in the network is down, or in use at any particular time, these members can try to access another computer.

The radio link can be used by virtually any amateur radio teleprinter station in the area that is equipped for 2-meter FM operation. Of course, *any* member of the club can access any computer by making a long-distance telephone call.

Data is collected in each computer for remote retrieval at a later time. If the data in one machine is addressed to a user outside the local telephone area, the data is automatically sent to the computer in the distant area in the late evening, when long-distance telephone rates are lowest. This intercomputer transfer takes place once per night per machine in a predetermined sequence to transfer the maximum number of messages with the minimum number of calls.

Link Types

Consider first the characteristics of the radio links. Many amateur radio operators already use noncomputerized automatic-starting radioteletypewriter equipment for receiving message traffic. A computer network for message handling is a logical successor to these existing autostart networks.

The existing noncomputerized network works as follows. All stations monitor the same frequency. Messages are sent blind; when a message is originated into the network, the sender does not know for certain if the destination station is

DECIDE FOR YOURSELF...

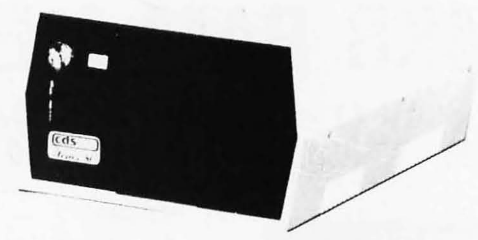


WISE 1 TERMINAL

Totally intelligent terminal which can be used for single or multi-user capabilities. Expandable into a complete system.

Suggested List Price $ 1695

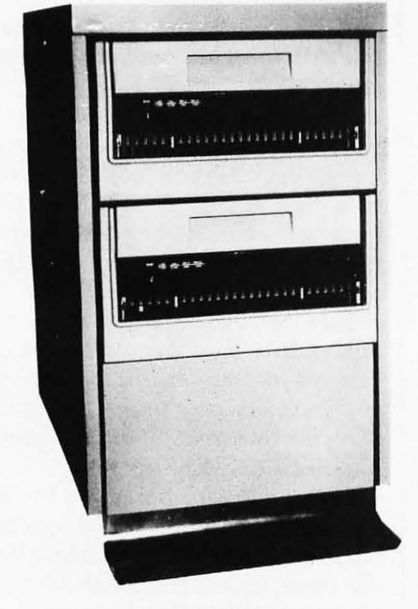




IPS-100 MICROCOMPUTER MAIN FRAME

Functions with the Wise 1 as a complete system or with most other dumb terminals.

Suggested List Price $ 3495



HARD DISK MODULE

32 Megabytes of on-line storage...16 fixed / 16 removable

Suggested List Price $11,995 shown w/ opt. rack & 2nd drive

...WHICH CDS SYSTEM BEST SUITS YOUR NEEDS

AUTHORIZED DISTRIBUTORS

In Florida
Datatron
11041 N.W. 44th Street
Coral Springs, FL 33065
(305) 753-7514

In Canada
House of Computers, Inc.
368 Eglinton Ave., West
Toronto, Ontario,
Canada M5N 1A2
(416) 482-4336

In Italy
Computer Data Systems, SRI
Scali D'Azeglio, 52
Livorno, Italy 57100
0586-376461/7

In Spain
Polytronica
Cavanilles, 30
Madrid, 7, Spain
252 55 89-433 27 34

DEALER INQUIRIES INVITED



Bldg.#3, Drummond Plaza
Newark, DE 19711
(302) 738-0933

DEALERS

Computer Data Systems, Inc. · 25 West Woodbine · Youngstown, OH 44505 · (216) 747-5539
All Type Business Systems · 57 Verdi Street · Farmingdale, NY 11735 · (516) 249-4650
Microprocessor Applications · Maskells Hill Road · Selby, Victoria, Australia 3159 · (03) 7545108
Realistic Computing of Georgia · 101 Mc Cartan Street · Augusta, Ga 30902 · (404) 722-0831
Computerease · 403 Milltown Road · Wilmington, DE 19808 · (302) 995-6546
Dotson & Wilson Consulting · P. O. Box 12152 · Lexington, Ky 40581 · (606) 233-9958
Forbes & Associates · P. O. Box 455 · Marlton, nj 08053 · (609) 435-0404
Freeman Electronics · 708 North 7th Street · West Monroe, La 71291 · (318) 388-2312
Diversified Data Systems · 9811 Mallard Drive · Laurel, MD 20811 · (301) 776-1200
Great Neck Computer Co. · 89-31 161st Street · Jamaica, NY 11432 · (212) 291-8880
Nova Group, Inc. · 2864 Hartland · Falls Church, VA 22043 · (703) 698-5116
Computer Center · 125 Pillow Street · Butler, PA 16001 · (412) 287-0754
Computer Center · 31 East 31st Street · New York, NY 10016 · (212) 889-8130
Texas Microcomputers · 120 North 10th Street · Mc Allen, TX 78501 · (512) 687-8744
Computer Sales Co. · 63 Gentry Court · Box 3351 · Annapolis, MD 21403 · (301) 267-6600
Integrated Business Systems · 7009 Prospect, NE · Albuquerque, NM 87110 · (505) 884-9705
Business Computer Systems, Inc. · 1401 Walnut River · Canton, MI 48187 · (313) 981-3180
Custom Business Computers · 4565 W. 77th Street · Suite 136 · Minneapolis, MN 55435 · (612) 831-1580
DeWalt Computer Sales - POB 253 - Lightstreet, PA 17839 : (717) 784-4496
Modulo-2 - 709 Supreme House, Penang Road, Singapore 0923 - Phone: 39843, 30539

monitoring the frequency, unless 2-way contact is first established. In the evening, or during weekends, this may not pose much of a problem, because the probability of someone being at home is great. However, during the working day, that probability decreases. Thus, if contact cannot be established directly, the message can still be *sent*, but there is a probability that the destination receiver will not be on line, and the message will be lost.

If, however, the message can be stored in a central computer by the sender, and retrieved later by the receiver, the probability of successful transmission of the message from sender to receiver is almost certain. The addition of a computer therefore becomes an asset to the network.

If several stations in the network have computers capable of answering back to the sender, the utilization of the computer may be reduced. A sender can put out a direct call. If an answer is not received (indicating that the destination is not on line or monitoring at the time), the message can either be transmitted to the computer for storage, or held and transmission attempted again at a later time. It is also possible for the assignment of which network computer will perform the store and forward operation to be rotated among the various member-station computers on basis of availability, as long as the network computer has a distinctive identification.

With a radio network set up in this way, anyone equipped either with simple radio-teleprinter equipment or with sophisticated computer equipment may make use of the full network message storage and forwarding capabilities. This concept of allowing minimally equipped stations to access the network requires that simple techniques be used for data transfer. These include 5-level ("Baudot") or ASCII plain language text, a control language that is readable by both man and machine, with minimal error checking. The advantages of more sophisticated techniques mean that many people will want to use them. That leads to a hierarchical concept of the network utilization. This will be discussed later.

The disadvantage of the radio network is that since everyone is on line, the privacy level is zero. Therefore, data that is not intended for public knowledge cannot be passed over the network. For this reason, mailing lists and other confidential club data should not be passed over the radio link. *[Also, FCC regulations require that* no *message traffic pertaining to any business or commercial activity may be transmitted by an amateur radio station...***RSS***]*

Use of the telephone line for gaining access to the computer limits the number of users that can be on line at the same time. One great advantage of the telephone line is security. The connection between the user and the computer is private. Mailing lists can be accessed and changed remotely without compromising the security of the data, provided that only authorized users are allowed access to these data files.

System Implementation

Bringing up the network for the first time can be simple or complex. One method is to install a computer equipped with dual floppy-disk drives, 32 K bytes of memory, and the phone line, and make it available 24 hours per day. It is an expensive method, especially when the demand

BACK AGAIN, BIGGER AND BROADER THAN EVER!

The 1980 Business & Home Computer Shows.

Last year's spectacular success in Boston broadens its reach this year into the prosperous Chicago and Washington/Baltimore markets as well. The Business & Home Computer Shows are coming up again. But space is going fast. So call now if you want to be a part of the hottest thing ever in regional end-user computer expositions.

A SMASH LAST YEAR; EVEN BETTER THIS YEAR.

A record-breaking 31,000 people attended the first of these shows in 1979, a three-day affair in Boston. This year's events are broadened to four days, and will have even bigger promotional budgets than ever. *In fact, the Business & Home Computer Shows have the largest national and regional advertising budget of any computer exhibits except NCC.*

SELLING SHOWS WHERE PEOPLE REALLY BUY.

The Business & Home Computer Shows produce solid results. These are eager audiences – about 70% businessmen and the rest hobbyists – primed with purchasing power in mini- and microcomputers, word processors, peripherals, and software. They come to buy. And cash sales are permitted throughout the show.

CALL NOW! SPACE IS RUNNING LOW.

Four hundred booths and 100,000 square feet of floor space for each of the three shows may sound big, and it is. But over half that space has already been sold, mostly to last year's participants. (Several companies tried single booths last year and are back again with reservations for 12 to 16 booths!) So hurry. Call Bill Mahan or Joan Donahue at (617) 524-4547 to get more facts and assure your reservation.

WASHINGTON/BALTIMORE: D.C. Armory/Starplex, Thu., Sept. 18 thru Sun., Sept. 21.
CHICAGO: McCormick Place, Thu., Oct. 16 thru Sun., Oct. 19.
BOSTON: Hynes Auditorium/Prudential Center, Thu., Nov. 20 thru Sun., Nov. 23.



P.O. Box 678, Brookline, MA 02147

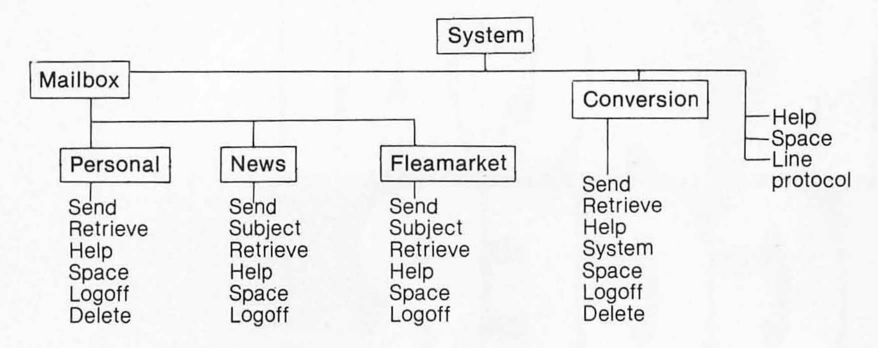


Figure 2: *Hierarchy of software modes in the club computer network software. Names of program routines are enclosed in boxes. Commands available with each program are listed below.*

for such a service has not yet been demonstrated in the club.

A second method is to bring the service on line gradually, using equipment belonging to club members, and then put together a club system as club finances allow. This method has the advantage that the cost can be spread out over a period of time, but does have a disadvantage because there will be many intervals during the early stages of the network implementation when the system is not available.

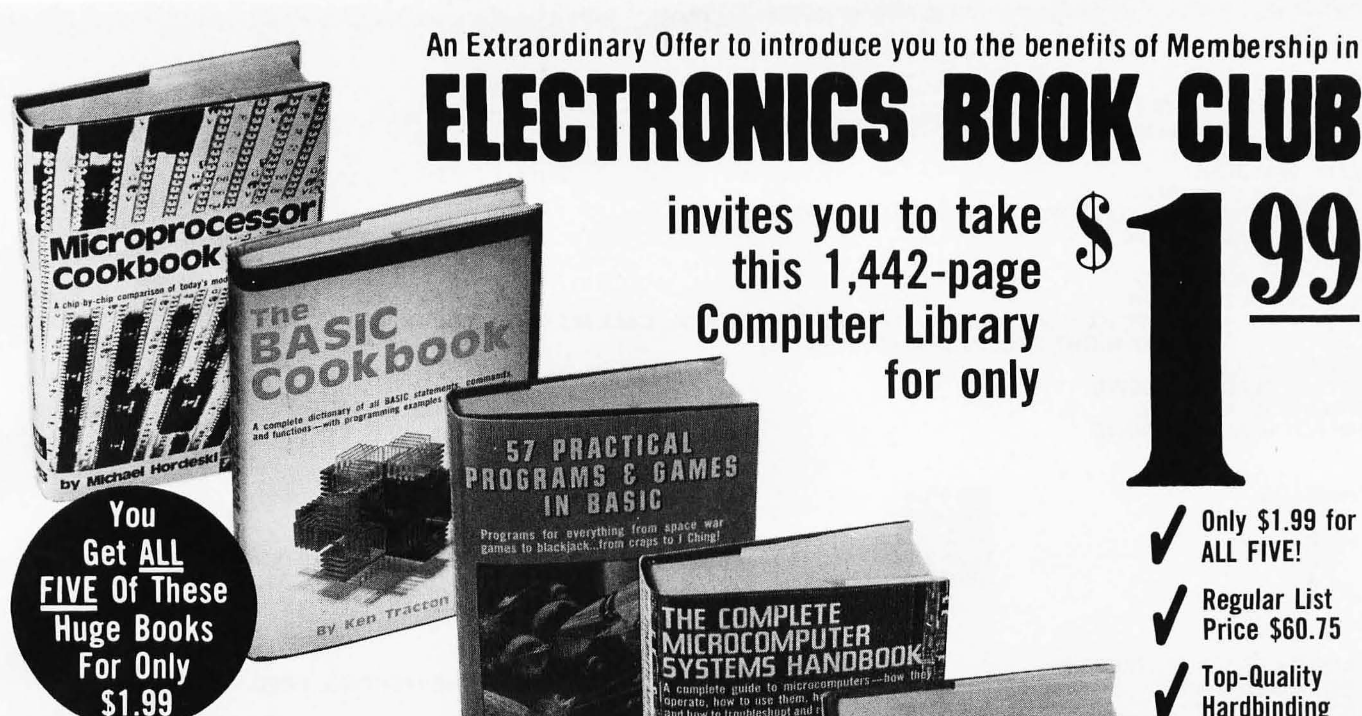
The network can be started by one or more club members making their personal systems available. On the radio link, there will be no noticeable difference with the different computers, since they should all answer to the same call sign, and the user need not know which machine is storing his traffic. In practice each computer will also transmit its own station call sign as required by law.

Telephone access is a little more difficult, because a list of numbers must be made available to the network members, and a rule must be established for dialing the computer. An example of such a rule is that if the computer does not answer by the second ring, dial another number.

When the system is first put into use, it will be lightly loaded. It can thus be used for secondary purposes apart from the message storage or media transfer applications. Club members will have a chance to use the sophisticated system and to play with it. The availability of any single computer during the early stages may be intermittent: since it is the personal system of a club member, it will be available for club use only when the owner is not using it. This unreliable accessibility will encourage members to upgrade their systems as fast as possible for their noncommunication uses. However, the system as a whole will have a greater reliability, since there is a good probability that at least one computer will be available when one is required.

Using the Telephone Link

The typical telephone communication system operates at a data rate of either 110 or 300 bits per second (bps), allowing the use of simple Bell 103-compatible modems. In order to set the data rate for a transmission, each user must transmit a carriage



- Only $1.99 for ALL FIVE!
- Regular List Price $60.75
- Top-Quality Hardbinding
- Contains the very latest info on computers!
- Over 600 illustrations
- Contains over 500,000 words
- 1,442 data-packed pages

Microprocessor Cookbook

A chip-by-chip comparison of the most popular modern microprocessors—including programming, architecture, addressing, instruction sets, and applications! You get complete data on what makes up the structure of a microprocessor chip and a microcomputer, how to give instructions, the overall organization of a computer system, and more. Then you get a chip-by-chip profile of modern microprocessors—with thorough discussions of applications, architecture, functions, etc. Included are the Intel 8080, Motorola 6800, Fairchild's F8 family, Zilog Z80, TI's TMS 9900, National Semi SC/MP, Intel's 8021, and many more. 266 pps., 124 illus. List $9.95

The BASIC Cookbook

A complete dictionary of all BASIC statements, commands, and functions—with programming examples and flowcharts. Thoroughly defines the BASIC vocabulary in alphabetical order, illustrates the definitions with sample programs, and further clarifies the programs with matching flowcharts . . . plus explaining BASIC system commands. You'll learn how to professionally manipulate and use each BASIC term in a workable program. Also defines programming terms that apply to APL, ALGOL, COBOL, FORTRAN, RPG, PL1, etc. 140 pps., 49 illus. List $7.95

57 Practical Programs & Games in BASIC

57 of the hardest working, most enjoyable BASIC programs you've ever seen . . . everything from space war games to blackjack, from craps to I Ching, from arithmetic progression to statistical permutations to one-arm bandits! It's an easy-to-use manual that gives you 57 different simplified BASIC programs . . . all ready to run! You can program your minibrain for all kinds of fun and games, or for solving many different types of problems. 210 pps., 64 illus. List $10.95

Complete Microcomputer Systems Hdbook.

A complete *guide to microcomputers*—how they operate, how to use them, how to program them, and how to troubleshoot, test, and repair them . . . plus the very latest on modern applications like magnetic bubble memories, computers in networks, computer decision making, simulation and forecasting, teaching machines to learn, robot control, speech synthesizers, digital music, mobile computers, etc. There's extensive coverage of computer problems and how to diagnose and repair them, plus lots of hard debugging data. You'll learn how to find and fix all types of mechanical and electronic troubles—plus how to use test signals and closed loop signals, how to replace chips, how to align disc drives, etc. 322 pps., 147 illus. List $15.95

The Giant Handbook of Computer Projects

This MAMMOTH 504-page step-by-step guide to building modern computers and accessories—CPUs, memories, I/O hardware, etc.—is a HUGE collection of ready-to-use construction info. It's a builder's dream, with projects, complete schematics, parts lists, and step-by-step construction instructions that let you build your own systems. Also contains a thorough discussion of microprocessors, with comparisons of several units, including the Kim-1, the Z-80, and the 8080, etc. . . . plus data on memory boards, RAM checkout, PROM programmers, memory chips, inexpensive input/output devices, paper tape systems, interfacing with clock chips, and more. 504 pps., 217 illus. List $15.95

Let us send you this 5-volume, 1,442 page Computer Library as part of an unusual offer of a Trial Membership in Electronics Book Club.

Here are quality hardbound volumes, each especially designed to help you increase your know-how, earning power, and enjoyment of electronics and computers. Whatever your interest in electronics/computers, you'll find Electronics Book Club offers practical, quality books that you can put to immediate use and benefit.

This extraordinary offer is intended to prove to you, through your own experience, that these very real advantages can be yours . . . that it *is* possible to keep up with the literature published in your areas of interest, and to save substantially while so doing. As part of your Trial Membership, you need purchase as few as four books during the coming 12 months. You would probably buy at least this many anyway, without the substantial savings offered through Club Membership.

To start your Membership on these attractive terms, simply fill out and mail the coupon today. You will receive the 5-volume Computer Library for 10-day inspection. YOU NEED SEND NO MONEY. If you're not delighted, return the books within 10 days and your Trial Membership will be cancelled without cost or obligation.

ELECTRONICS BOOK CLUB, Blue Ridge Summit, Pa. 17214

Facts About Club Membership

- The 5 introductory books carry a publisher's retail price of $60.75. They are yours for only $1.99 for all 5 (plus postage/handling) with your Trial Membership.
- You will receive the Club **News**, describing the current Selection, Alternates, and other books, every 4 weeks (13× a year).
- If you want the Selection, do nothing; it will be sent to you automatically. If you do not wish to receive the Selection, or if you want to order one of the many Alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery, you do not have 10 days to make a decision and so receive an unwanted Selection, you may return it at Club expense.
- To complete your Trial Membership, you need buy only four additional monthly Selections or Alternates during the next 12 months. You may cancel your Membership any time after you purchase these four books.
- All books—including the Introductory Offer—are fully returnable after 10 days if you're not completely satisfied.
- All books are offered at low Member prices, plus a small postage and handling charge.
- **Continuing Bonus:** If you continue after this Trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates plus payment of the nominal sum of $1.99 will entitle you to a valuable Book Dividend of your choice which you may choose from a list provided Members.

ELECTRONICS BOOK CLUB

Blue Ridge Summit, Pa. 17214

Please open my Trial Membership in ELECTRONICS BOOK CLUB and send my 5-volume Computer Library, invoicing me for only $1.99 plus shipping. If not delighted, I may return the books within 10 days and owe nothing, and have my Trial Membership cancelled. I agree to purchase at least four additonal books during the next 12 months after which I may cancel my membership at any time.

Name ____________ Phone ____________

Address ____________

City ____________

State ____________ Zip ____________

(Valid for new Members only. Foreign and Canada add 15%.) BY-580

Circle 126 on inquiry card.

```
CMC NETWORK. ENTER LOGON: – G3ZCZ
G3ZCZ LOGON IN PROGRESS AT 1115 ON 6 NOV 1978
4 MESSAGES
READY MAILBOX
MAILBOX READY HELP
CHOOSE BETWEEN 'SEND, RETRIEVE, HELP, SPACE, LOGOFF'
MAILBOX READY SPACE
DISC SPACE = 25K
MAILBOX READY SEND
DESTINATION? WB4APR
INPUT: —        BOB, WE HAVE TO DISCUSS THE RADIO PROTOCOL. CALL ME WHEN YOU HAVE A MOMENT, BETWEEN 9 AND 11
                PM ANY NIGHT EXCEPT FRIDAY. [control-Z]
MESSAGE ACCEPTED
MAILBOX READY RETREIVE
RETREIVE IS NOT VALID
MAILBOX READY RETRIEVE

MESSAGE          SOURCE           DATED
   1             WB4APR           1 NOV 1978
   2             CMC 105          3 NOV 1978
   3             TERRY FOX        5 NOV 1978
   4             G8BTB            5 NOV 1978

MAILBOX READY RETRIEVE 2
MESSAGE READS:      BRING THE DOCUMENTATION ON THE GLOOP BOX TO THE MEETING. FRED.
MAILBOX READY
```

Figure 3: *Sample interaction between the author (G3ZCZ) and the Chesapeake Microcomputer Club-Amateur Radio Development Association (CMC-AMRAD) computer system. Characters sent by the system are shown in regular type; those typed by the user are shown in boldface type. Note that when the "RETREIVE" command (a misspelling) is entered, an error message is generated by the system.*

return character so that the computer can set up the correct data rate. Once the data rate is established, the computer sends out a sign-on message and asks the user to log in with an identification code. This identification can be a membership number, an amateur radio call sign, or some arbitrary name. It is limited to a length of eight characters. The computer will then indicate the presence or absence of any personal messages addressed to the user that has just logged in.

The software in each computer is identical in behavior and is organized in a structured top-down approach as shown in figure 2. The user has a choice of programs as shown that perform the various functions. Various commands are associated with each program as listed. Consider each program and mode in turn.

The *mailbox* program is designed to enable club members to send short messages (up to 256 characters) to each other. The messages are in plain language. The response to a SEND command is to prompt the user with DESTINATION? Upon entering the identification code of the destination, the user is prompted to send the message and terminate it with a control-Z character. Should more than 256 characters be entered, the entire message will be rejected. This discourages long messages.

The response to the RETRIEVE command is to list the sender identification of each message in the system awaiting the user.

A sample user session is shown in figure 3. The computer output is shown in regular type, the user input in boldface type.

The other messages may be retrieved in turn. The RETRIEVE command has the following characteristics: If followed by a carriage return, it lists all messages. If followed by a 0, it lists all messages. If followed by a number, it lists the corresponding message.

Identification numbers are assigned to the messages only to allow the user to retrieve them. The numbers are reassigned as messages are deleted.



No matter what type of personal computer you have, or are thinking of buying, Eaton LRC's new 7000+ dot-matrix impact printer can be interfaced with plug-in simplicity and be printing in just a matter of seconds.

The 7000+ features uni-directional printing with a line speed of 1.25 lines per second. It accepts any single or two-ply paper roll from 3/4-inch to 3-7/8 inches wide and prints a 3-1/3 inch line. Capacity is adjustable and can be 40 columns at 12 characters to the inch using the single width font; or 20 columns at 6 characters to the inch using the double-width font. The 7000+ accepts the full ASCII character set (upper and lower case). An available option allows the unit to print 64 columns at the single width setting, and 32 columns using a double width font, selectable under software control.

The new 7000+comes equipped with Eaton LRC's newest printhead with a minimum life of 100-million characters. This new, long-life head has been carefully designed to print continuously without overheating.

7000+ (40 & 20 columns) List $389 .... $369
APPLE*cable $20
7000+ (64, 32, 40 & 20 col.) List $405 ...... $389
TRS-80*cable $20

DEALER INQUIRIES INVITED

TRS-80* COMPUTERS:

Level II, 4K (list $619) $559
Level II, 16K, no keypad $669
Level II, 16K, w/keypad (list $849) $749

EXPANSION INTERFACES:

Exp. Int., no RAM (list $299) $269
Exp. Int., 16K RAM, (NEC) (list $448) $369
Exp. Int., 32K RAM, (NEC) (list $597) $459

DISK DRIVES:

Percom, TFD-100, 40-track (list $399) $389
Percom, Dual TFD-100's (list $795) $775
Percom, TFD-200, 77-track (list $675) $650
Percom, Dual TFD-200's (list $1350) $1300
RS Mini-Disk #0 (list $499) $449
RS Mini-Disk #1-2-3 (list $499) $439

DISK DRIVE ACCESSORIES:

2-drive cable for TRS-80 (list $29.95) $29
4-drive cable for TRS-80 (list $39.95) $39
Percom Data Separator $29.95
Extender Card (list $15.95) $15

PRINTERS:

Centronics 730 (list $795) $719
Centronics 737 (list $995) $895
Centronics 753-2 (list $3196) $2695
Centronics 779-2 (list $1559) .... $ 995
RS Quick Printer II ($219) $197
RS Line Printer III (list $1960) $1813
NEC 5530 Spinwriter (list $2995) $2595
LRC 7000+ (list $389) $369
LRD 7000+ (list $405) $389

PRINTER CABLES:

QPII to Exp. Int. cable ($19.95) $19
LRC to TRS-80 cable (list $20) ....
730 to TRS-80 cable $29
779 or 753 to TRS-80 cable $35
NEC 5530 to TRS-80 cable $35

PERIPHERIALS:

Novation CAT Modem ($189.95) $179
UDS 103-LP $195
RS-232-C Interface Board (list $99) $89
TRS-232 Printer Interface $49.95
Data Dubber $49.95
16K Memory Kit, Keyboard $99
16K Memory Upgrade Kit, E.I. $95
Percom Electric Crayon, w/cable $279.95
Busy Box $109.95
BSR X-10, Starter Kit $124.95
Comm-80 Interface $179.95



*TRS-80 is a trademark of Radio Shack and Tandy Corp. *Apple is a trademark of the Apple Computer Co.

Deletion of messages is allowed by the system under restricted conditions. Only the system manager, the sender, or the retriever can delete messages. Each user is assigned a password that must be entered prior to a DELETE command. This allows some degree of security. Messages will be deleted by the system manager periodically, depending on the storage requirements of the system.

In the *news* and *fleamarket* modes, updates are handled by a single club member designated for that duty. All messages for input to the system are routed to this person for scanning before being placed on the system. This is to keep the system from being cluttered up with undesirable messages. Updates of these messages take place as time permits, with a maximum delay time of one week.

The *conversion* program is designed for exchange of data between different media. One club member desiring to receive a data file from another will arrange for the second member to put the file into the system for retrieval within hours. The expected life of a file in the conversion mode is about 24 hours. Conversion uses a different protocol than the mailbox mode. Since long files are being exchanged, the data flow has to be stopped from time to time to allow disk read and write operations. A full-duplex mode is used.

The maximum message length of 256 characters applies in all modes except conversion. Messages with more than 256 characters are rejected in their entirety. This encourages brevity. A rejection message is printed by the computer to the sender in the case of a message rejection. A user who has to retype messages will soon get the idea.

Several existing network systems carry a large number of undesirable messages. We hope to minimize them in the CMC-AMRAD network. Any user trying to enter unwanted messages may have them rejected by the system manager.

Data Complexity Levels

Data may be transmitted over a link at one of several levels of complexity of internal organization. The basic level (level 0) is plain ASCII-encoded text in half-duplex mode. Level 1 is a simple ASCII-based, full-duplex mode developed by Tim Pugh. Level 2 is an emulation of the PCNET (personal computer network) protocol. Level 0 is used by anyone in talking to the computer during execution of any user program. Level 1 may be used in the conversion mode, while Level 2 is used for intercomputer data exchange. Any properly equipped user can request any level when he logs onto the system.

Any club member having an *answer-mode modem* can run the basic network system software on his or her machine. An extension can be made to the system to allow access to the disk operating system so that other club members can play with the other software available on the machine.

Radio Restrictions

Mailbox and news are the only categories of data exchange available via radio links. Conversion-mode data may contain binary or other unusually coded files, and fleamarket may contain advertisements; radio transmission of both of these classes of messages is forbidden by law.

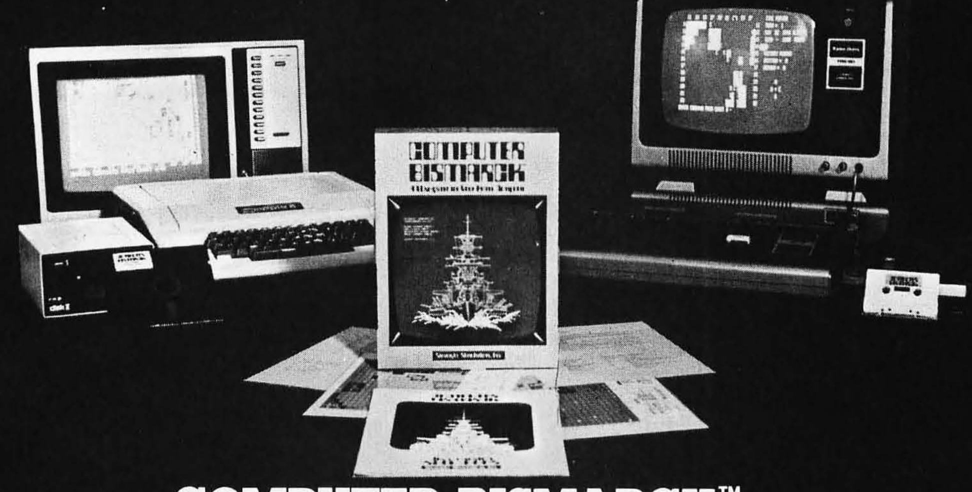
The procedure for logging onto the system is different from the one used over the telephone. Half-duplex mode is employed when using a single-band repeater, such as the 147.81/147.21 MHz AMRAD machine. If the inputs and outputs were on different amateur frequency bands, full-duplex operation would be easily achievable. In order to avoid the requirements for duplex exchanges and to reduce the amount of information exchanged, the modified Q *code* is employed. See my article "The Sky's the Limit: Use Ham Radio Bands for Intercomputer Communication" (November 1978 BYTE, page 48), for a more complete discussion of the use of these Q codes.

[The Q code is a system of 3-letter abbreviations that all begin with the letter Q. Various Q codes are used during Morse-code radio transmissions to speed up message exchange. An adapted set of Q codes is used for computer network communication... **RSS***]*

Any amateur can log into the network and receive a reply from any on-line computer that has a message for him or her. Thus, users without computers can store their messages in the network computer; those with computers can leave messages on their own machine for later remote retrieval. Possible contention interference (from more than one machine simultaneously trying to communicate over the network) can be overcome initially by employing a different time-delay response characteristic for each computer in the network (both user and system computers).

The radio link can also be used for long-distance links between the club network and other club networks. Again, see "The Sky's the Limit" for a more complete discussion. ■

INTRODUCING A GREAT WARGAME FOR TWO GREAT HOME COMPUTERS.



COMPUTER BISMARCK™ FOR YOUR APPLE II OR TRS-80.

Historical wargaming may be the only intellectual hobby which creates more intensely devoted fanatics than home computing. When two wargamers spend an evening refighting a famous battle, they'll spend several hours happily setting up the gameboard, firepower charts, unit strength tables and so forth . . . all before the first shot can be fired! There are such paper & pencil simulations of every famous battle from Shiloh to El Alamein. If you've ever tried one, you already know the excitement and challenge of trying to be a better general than Rommel.

Home Computer

Now there's a true historical wargame for your home computer. Computer Bismarck accurately simulates the epic battle between the awesome German battleship and the British Home Fleet. Best of all, the computer program eliminates the drudgery of paper & pencil wargames — remembering all the rules and details while keeping track of the battle on a North Atlantic map on your video display.

Play the Computer

It maneuvers the Bismarck and Prinz Eugen so well that you'll have to command the British ships brilliantly to avoid losing your vital merchant convoys.

Play a Human

The two of you plot your strategies in grease pencil on an off-screen mapboard while the battle is fought on the video screen (monochrome or multi-color depending on your display capabilities). You deploy battleships, cruisers, carriers — each with unique and realistic operating parameters. You must deal with all the variables which challenge an actual battle commander: firepower and damage; shadowing ability (better in radar-equipped vessels); and visibility — which depends on weather, which varies with geography and time. If the game is interrupted, the computer saves it on a minidisc for resumption later.

More like Chess than Pong

Computer Bismarck is a test of intellect and courage rather than hand-eye coordination. If you can imagine playing chess with pieces like a knight who must return to the stables periodically for a fresh horse or a queen whose radius of action can be affected by battle damage . . . all on a 360 square chessboard partially obscured by fog . . . that's Computer Bismarck!

Cassette for Your TRS-80

We've just described the cassette version of Computer Bismarck which is played on a 16K Level II TRS-80 system. For $49.95 you get a programmed cassette, a 12-page rule book, 2 mapboard charts (for plotting secret strategies in grease pencil between moves), 2 ship data charts, and a set-up instructions sheet.

Disc for your Apple

The disc version includes all of the cassette features plus actual submarine, destroyer, convoy, and aircraft units that are moved by the players. Players must also deal with fuel restrictions on both ships and planes and with the ever-changing weather of the North Atlantic.

If you've got an Apple II Plus (or an Apple II with Applesoft ROM Card) with 48K memory and a 5¼" mini floppy disc drive, you can be playing Computer Bismarck in a few days. For $59.95 you get the game program disc, 2 mapboard charts, 2 ship data charts, 2 system command cards, a loading instruction sheet, and a rulebook — everything you need to play one of the most exciting wargames ever designed!

Credit card holders call **800-648-5600** (toll free) and ask Operator 180 to charge your order to your VISA or MASTERCHARGE (Nevada only call 800-992-5710). Or send a check to Strategic Simulations, Incorporated, P.O. Box 5161, Stanford, CA 94305 (California residents add 6.5% sales tax).

For complete details and an inside look at Computer Bismarck, we'll mail you its rulebook. Just send us a check for $5 along with your name and address. Please indicate cassette or disc version rulebook. The $5 will be credited to your purchase of Computer Bismarck.

COMPUTER BISMARCK.™ There's never been anything like it.



Circle 130 on inquiry card.

The COSMAC Doodler

Jeff Duntemann
301 Susquehanna Rd
Rochester NY 14618

When the COSMAC ELF microcomputer first appeared several years ago, its designer called it a microcomputer trainer. That meant that you had a few hexadecimal displays and a light-emitting diode (LED) to play with in your programs, and nothing else. Clever people managed to make the ELF play music or even generate Morse code without much additional hardware.

As far as I know, the ELF is the only microcomputer that has often been built from scratch by hobbyists without using a predesigned printed-circuit board. There is *no* better way to learn microprocessor hardware than to buy a handful of parts and wire-wrap all of the connections. In ironing out your mistakes, you will become familiar with every processor timing signal, every kink in every system timing diagram, and every little architectural quirk that can grow up to be a big bug in later programs. It is a rigorous education, I promise you, but an excellent one.

Then RCA released the CDP1861 video-display-controller integrated circuit for sale, and suddenly the ELF could do something no comparable computer could do for triple the price. With the CDP1861, the ELF displays a bit-map of 1024 bytes of memory on a video screen (in black and white), with no hardware needed except the CDP1861 and several resistors, and with software consisting of a 30-byte interrupt routine.

This development was not purely a gift to hobbyists, of course. The CDP1861 formed the heart of RCA's Studio One home video game. In such games cost is probably the most important factor. Video-game-type graphic displays are now easily done on the ELF. The fourth article in the ELF series ("Build the PIXIE Graphics Display," Joseph A Weisbecker, *Popular Electronics*, July 1977, page 41) outlined the hardware required and included a simple test program, but it was up to hobbyists to come up with video software to make the ELF earn its keep.

The Video Doodler program presents a winking cursor in the upper left-hand corner of the screen. By actuating toggle switches, the cursor can be made to move horizontally, vertically, or diagonally. As it moves, it either leaves behind a trail of white dots against the black background, or it "eats" previously written white dots and lines back to blackness. Once you fill the screen, one push of the INPUT switch wipes it clean again.

Memory Requirements

The only problem is the program's size. Within the limits of a typical ELF one-page memory system, there is no room left in memory after you toggle in the program to do any drawing on the screen. The only way out of this problem is to expand memory to at least two 256-byte pages. If you shop wisely, you can do this for less than $9.00. Adding another page of memory requires only two additional 2101 static memory chips and a CD4042 complementary metal-oxide semiconductor (CMOS) latch. Figure 1 details an ELF two-page memory system.

If you do not intend to add much more memory beyond two or three pages, you might consider replacing

Text continued on page 218

About the Author

Jeff Duntemann works for Xerox Corp. He has built a small robot (named Cosmo) that he controls with his computer, and enjoys amateur radio operation (as KB2JN). His writing is not confined to technical articles; he has had a science fiction story published in Isaac Asimov's Science Fiction Magazine.

OSBORNE/McGraw-Hill presents . . .

The World's Best Selling Microcomputer Text REVISED!

An Introduction to Microcomputers

An Introduction to Microcomputers: Volume 1 — Basic Concepts
2nd Edition, by Dr. Adam Osborne

This new edition of Volume 1, published in April 1980, incorporates all of the newest technology. Basic microprocessor concepts are discussed in terms of modern hardware configurations, and examples of common microcomputer applications are drawn from today's most popular devices. For example, the logic instructions and programming concepts of the new 16-bit microprocessors are discussed in detail, and current logic distribution configurations are used throughout the text, illustrations and examples. Programming mnemonics conform to the newly proposed IEEE standard. This book is the first in print to use them, a feature which will be appreciated by beginners and professionals alike.

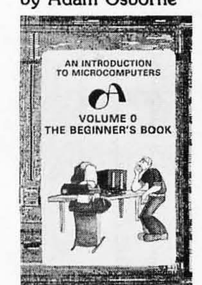
Basic Concepts presents the fundamental logic framework upon which microcomputer systems are built, so that the reader can evaluate the applicability of microcomputers to any practical problem. Using concepts that are common to all microprocessor systems, **Volume 1** develops a detailed picture of what a microcomputer can do, how it does what it does, and how its particular capabilities can best be applied.

#34-9, $12.50

Over 200,000 copies sold since December 1975. Now completely revised! The most current and topical book on the market!

Also in the **Introduction to Microcomputers** series:

Volume 0 — The Beginner's Book
by Adam Osborne



This book introduces computer logic and terminology to the complete beginner in the field of microcomputers. Numerous illustrations and photographs combine with clear, easy-to-follow text to provide an elementary but broad-based background.

#26-8 $7.95

Volume 2 — Some Real Microprocessors
by Adam Osborne et al.

This unique reference provides objective descriptions of virtually every microprocessor on the market today. Lets you know what's available, how they work (or don't work), and how to use them. Loose-leaf. Binders and yearly updates (six issues) sold separately.

Vol. 2 book, 1978 ed.	#15-2	$25.00
Vol. 2 binder	#16-0	$ 5.00
Vol. 2 1978/79 updates	#97	$25.00

Volume 3 — Some Real Support Devices
by Jerry Kane et al.

Same objective, in-depth coverage as Volume 2, but applied to support devices: memory, data converters, data communication devices, direct memory access controllers, busses, and much more. Loose-leaf. Binders and yearly updates (six issues) sold separately.

Vol. 3 book, 1978 ed.	#18-7	$15.00
Vol. 3 binder	#19-5	$ 5.00
Vol. 3 1978/79 updates	#98	$25.00

Combined update subscriptions can be purchased for both Volume 2 and 3, a total of twelve update issues. #99 $40.00

Book	Price	Quantity	Amount
#			
#			
#			
#			

Calif. residents add 6% sales tax.
S.F. BART residents add 6½% sales tax.
No tax on update subscriptions.

Subtotal	
California residents tax	
Shipping	
TOTAL	

SHIPPING (Shipping for large orders to be arranged)
- □ All foreign orders $4.00 per item for air mail
- □ No charge in the U.S. on update subscriptions
- □ $0.75 per item 4th class in the U.S. (allow 3-4 weeks)
- □ $1.25 per item UPS in the U.S. (allow 10 days)
- □ $2.50 per item special rush shipment by air in the U.S.

For faster shipment or credit card, phone (415) 548-2805

NAME: __________
ADDRESS: __________
CITY: __________ STATE: __________
ZIP: __________ PHONE: __________



630 Bancroft Way, Dept. B4
Berkeley, CA 94710
(415) 548-2805
TWX 910-366-7277



S1089

Circle 132 on inquiry card.

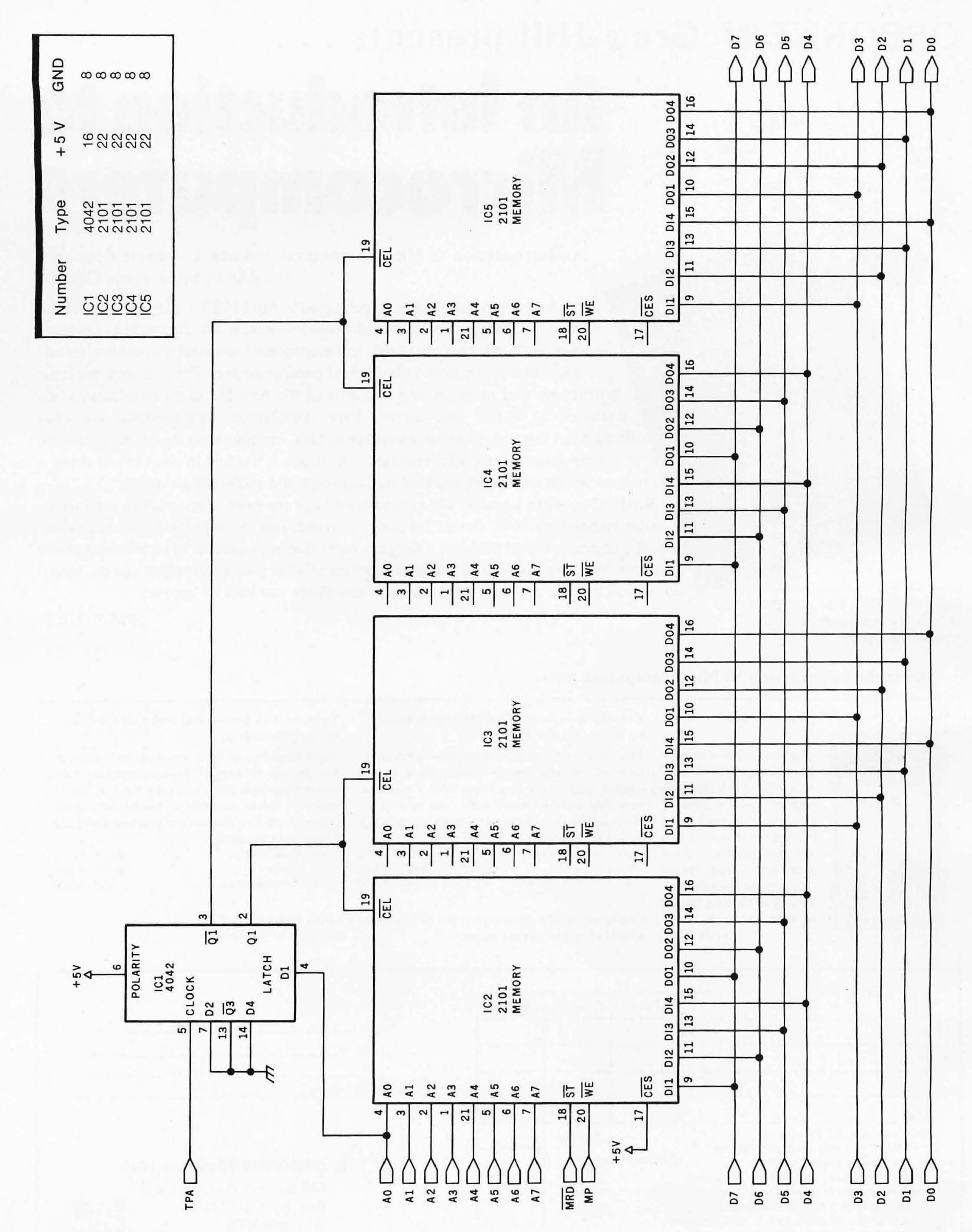


Figure 1: *Schematic diagram of a two-page programmable-memory system that can easily be added to a COSMAC ELF microcomputer. Pins 17 and 22 of the memory parts should not be connected together. Instead of 2101 memory devices, it is possible to substitute CMOS 5101, 74C920, or CDP1822CD parts. Use of complementary metal-oxide semiconductor memories enables the use of batteries to retain data in memory even when the main power supply is shut off.*

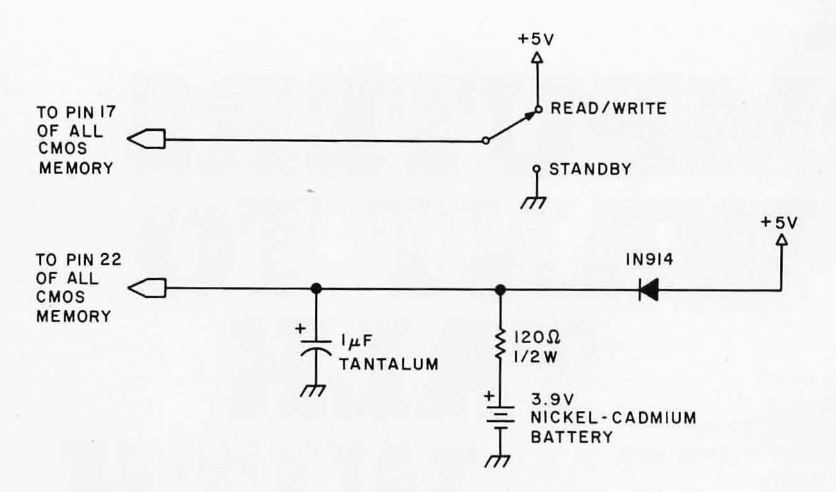


Figure 2: *Memory data-retention circuit for CMOS memories. Do not use this circuit with a 2101-type memory. The nickel-cadmium battery cells charge during normal operation, and thereafter maintain data in the memory when main power has been turned off.*

Text continued from page 214:

your 2101 devices with CMOS 5101 or CDP1822 memory. A small 3.9 V battery can allow data to be retained in CMOS memory even when the main power is off, thus keeping you from facing the exasperating job of toggle-loading 195 bytes every time you want to show off the Doodler.

If you can locate a 3.9 V nickel-cadmium battery, the circuit in figure 2 can be built and then forgotten about. The ni-cad will charge while the power is on, and keep memory alive when power is off. If you operate your ELF at least a few hours per month, the battery will never fully discharge.

Register Use

The Doodler program makes heavy use of the COSMAC general-purpose registers. A register-use summary is given in table 1 to keep everything straight while you are trying to understand the program's operation.

Where Is the Cursor?

It takes two pointers to specify a cursor position on the screen. The *byte pointer* is the memory address of a single byte somewhere among the 256 bytes displayed on the screen.

The *bit pointer* is a byte stored in half of a general-purpose register. Only one bit of this byte ever contains a binary 1. This bit represents the position of the cursor within the byte indicated by the byte pointer.

The Doodler actually has two sets of pointers for its cursor. The permanent pointers contain the actual position of the cursor at any given time. The temporary pointers are modified during each scan of the toggle switches.

The toggle switches are read and separately tested by shifting bits out of the D register (COSMAC's accumulator). Each of the first five switches controls a program function. If the first toggle switch is actuated, the temporary bit pointer is shifted one bit to the right. If during this shift the bit crosses over into the next byte, the temporary byte pointer is incremented by one.

Actuating the second toggle switch shifts the bit pointer to the left, and decrements the byte pointer if the bit crosses the border into the next byte leftward. The third toggle switch adds the hexadecimal value 08 to the byte pointer. This does not affect the

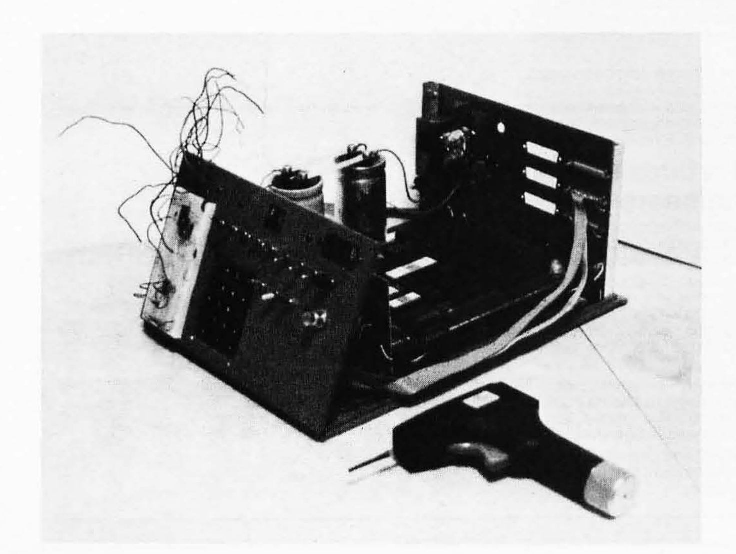


Photo 1: *The author's homebrew COSMAC computer system. It contains 2560 bytes of memory and uses a full 16-bit address display. Important processor and input/output signals are brought out through the front panel for ease in breadboarding.*

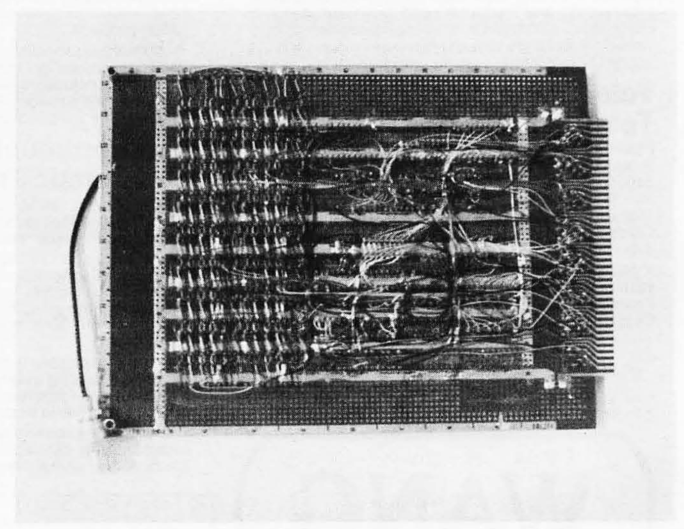


Photo 2: *Bottom side of the processor board. Six weeks of evening work with an OK Tool Hobby Wrap wire-wrap gun and 150 feet of wire were needed to complete the connections.*

cursor's horizontal position (the bit pointer remains the same), but the cursor is moved down one row. Similarly, the fourth toggle switch subtracts hexadecimal 08 from the byte pointer. This makes the cursor move one row upward.

Only after the toggle switches have been completely scanned are the values in the temporary pointers transferred to the permanent pointers, and the cursor moved to its new position. This makes motion on the diagonal possible without visible up-and-across motion on the way to the new position. If all four toggles are actuated, the cursor does not move. The four motions cancel one another before any information is transferred to the permanent pointers.

The fifth toggle switch determines whether the bit written into the cursor position will be a white dot or a blank space.

Register	High Byte	Low Byte
0	Direct-memory-access pointer	Direct-memory-access pointer
1	Interrupt program counter	Interrupt program counter
2	Stack pointer	Stack pointer
3	Main program counter	Main program counter
4		
5	BNKWRT program counter	BNKWRT program counter
6	DOTWRT program counter	DOTWRT program counter
7		
8	DELAY program counter	DELAY program counter
9	Temporary byte pointer	Temporary byte pointer
A	Inter-shift D storage	Temporary bit pointer
B	Permanent byte pointer	Permanent byte pointer
C		Permanent bit pointer
D	Blanking pointer	Blanking pointer
E	Delay-timing constant	Delay-timing constant
F		

Table 1: *Use of COSMAC 1802 16-bit registers by Video Doodler program.*

Operation of Subroutines

Two subroutines accomplish the transfer of information from temporary to permanent pointers and the final writing of the cursor bit onto the screen. If the fifth toggle is actuated, subroutine BNKWRT does the job and writes a 0 (blank) into memory at the cursor position. If the fifth toggle is not actuated, the job is done by DOTWRT, and the cursor leaves a white dot behind in memory and on the screen.

A third subroutine, DELAY, slows the process down so that you can direct the cursor intelligently on the screen. The execution time for DELAY (and thus the speed at which things happen) is determined completely by the constant that begins at memory location 0046. You increase or decrease this constant to slow the program or speed it up.

Text continued on page 224

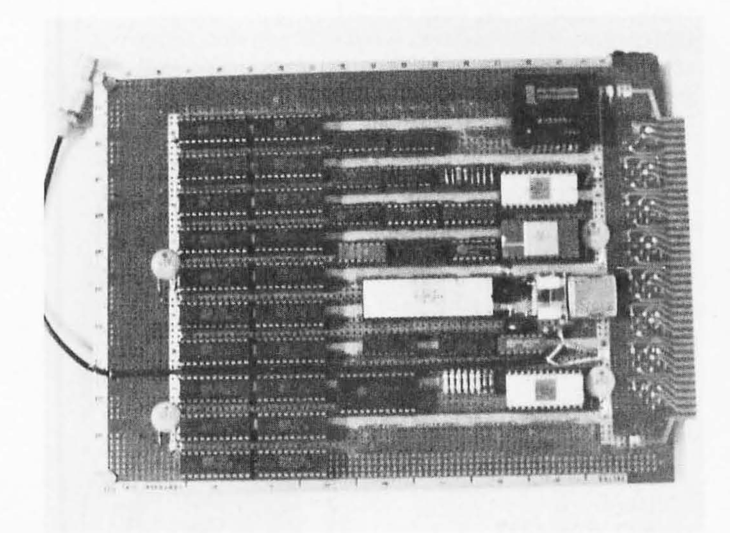


Photo 3: *Component side of the processor board. The video signal is brought off the board by the miniature 75-ohm coaxial cable.*



Photo 4: *Display produced using the Video Doodler. The isolated dot at the center right is the winking cursor.*

ALMOST PERFEC.

The MAGIC WAND™ is the most powerful, most flexible, most reliable, *most usable* word processing software available for a CP/M®-based computer.

That's not bragging. That's just telling it like it is.

The MAGIC WAND *is* the best word processing software ever written for a microcomputer. It can do more work in less time with higher quality than any other product you can buy.

The MAGIC WAND is a rock solid piece of software. The command structure is simple and logical and complete. We have not tossed in features without thought to the overall design of the package. Nor have we included any feature that is not thoroughly implemented. The programs are crash-proof and completely reliable.

And the system is supported by what we are told is the best user's manual ever produced for microcomputer software. It contains a step-by-step instructional program designed for the novice. The trainee uses sample files from the system disk and compares his work to simulated screens and printouts in the manual.

Support doesn't stop when you buy the package. As a registered user, you receive our bi-monthly newsletter which answers questions, reports upgrades and teaches new applications of the MAGIC WAND.

It's through a lot of hard work that we are able to offer you a product that is "almost perfect," but we aren't about to stop working until we can say that the MAGIC WAND *is* perfect.

Full screen text editing

The MAGIC WAND has probably the most responsive and easy-to-use editor available for either a serial or DMA terminal. It uses only single stroke control keys to give command and takes advantage of the special function keys on your terminal whenever possible. In addition, you can set up library files with coded sections that you can merge by section name.

Full text formatting commands

The MAGIC WAND allows you to set the left, right, top and bottom margins, page length, indentation, paragraph indentation, (incuding "hanging" paragraphs), text left flush, right flush, justified (two ways), literal or centered, variable line and pitch settings, variable spacing (including half lines), bold face, underlining (solid or broken), conditional hyphenation, sub- and superscripting. You may change any of these commands at run-time *without reformatting the file.*

Merging with external data files

You may access any external data file, with either fixed length or sequential records. The MAGIC WAND converts the record into variables that you define and can use like any other variable. Of course, you may use the data for automatic form letter generation. But you can also use it for report generation.

Variables

You may define up to 128 variables with names of up to seven characters. The current value of a variable may be up to 55 characters, and you may print it at any point in the text without affecting the current format. Although the MAGIC WAND stores the variables as strings, you may also treat them as integer numbers or format them with commas and a decimal point. You may increment or decrement numeric variables or use them in formatting commands.

Conditional commands

You may give any print command based on a run-time test of a pre-defined condition. The conditional test uses a straightforward IF statement, which allows you to test any logical condition of a variable. You may skip over unneeded portions of the file, select specific records to print, store more than one document in a single file, etc.

True proportional printing

The MAGIC WAND supports proportional print elements on NEC, Diablo and Qume printers. Other formatting commands, including justified columns, boldface, underline, etc., are fully functional while using proportional logic.

Available on 8" soft-sectored and 5 1/4" Northstar or Micropolis (hard or soft sectored) diskettes, as well as ONYX hard disk. Terminals supported include—ADDS, Beehive, Cromemco, Dynabyte, Hazeltine, Heath, Imsai, Intertec, Lear Siegler, Microterm Act V, Perkin Elmer, Sol VDM1, Soroc, TEC, TEI, Televideo, TRS80 Mod II, Vector Graphics, plus a variety of video boards.

small business applications, inc.

3220 Louisiana • Suite 205 • Houston, Texas 77006 • 713-528-5158

CP/M is a registered trademark of Digital Research Corp

Circle 134 on inquiry card.

Listing 1: *Video Doodler program in machine code for the COSMAC ELF.*

Address	Hexadecimal Code	Comments
00	F8 00 B1 B2 B3 B5	Initialize high-order registers
06	B6 B8 A9 AB	and byte pointers
0A	F8 01 B9 BB BD	
0F	F8 80 AC AA	Initialize bit pointers
13	F8 28 A1	Initialize interrupt PC
16	F8 FF A2	Initialize stack pointer
19	F8 66 A3	Initialize MAIN PC
1C	F8 5A A5	Initialize BNKWRT PC
1F	F8 4F A6	Initialize DOTWRT PC
22	F8 45 A8	Initialize DELAY PC
25	D3	Begin executing MAIN PC
	INTERRUPT	
26	72 70	Restore D, X, & P
28	22 78 22 52	Push P, X, & D onto stack
2C	C4 C4 C4	NOP s for sync delay
2F	F8 01 B0 F8 00 A0	Re-point R0 to display page
35	80 E2	Prepare for first DMA cycle
37	E2 20 A0	DMA reset
3A	E2 20 A0	DMA reset
3D	E2 20 A0	DMA reset
40	3C 35	Test for refresh done
42	30 26	Go to return
	DELAY	
44	D3	Return to MAIN
45	F8 07 BE	Load timing constant into RE
48	2E	Decrement RE
49	9E	Load RE.1 into accumulator
4A	3A 48	Loop again if not done
4C	30 44	Go to return
	DOTWRT	
4E	D3	Return to MAIN
4F	89 AB	Update byte pointer
51	8A AC	Update bit pointer
53	EB	X=B
54	F1	Combine bit pointer & screen via OR
55	5B E2	Write dot to screen
57	30 4E	Go to return
	BNKWRT	
59	D3	Return to MAIN
5A	89 AB	Update byte pointer
5C	8A AC	Update bit pointer
5E	FB FF	Inverts D via XOR IMMEDIATE
60	EB	X=B
61	F2	Combine bit pointer & screen via AND
62	5B E2	Write blank to screen
64	30 59	Go to return
	MAIN	
66	E2 69	Turn CDP1861 on
68	3F 75	Skip clearing routine unless INPUT pressed
6A	F8 FF AD	Point RD to top of display page
6D	ED	X=D
6E	F8 00 73	Store 00 on screen & decrement pointer
71	8D	Load pointer into D
72	3A 6E	Loop again if not done
74	5D	Store 00 in last byte of display page
75	E2 6C	Input toggles
77	F6 33 89	Tests "move right" bit & branches
7A	F6 33 98	Tests "move left" bit & branches
7D	F6 33 A7	Tests "move down" bit & branches
80	F6 33 AF	Tests "move up" bit & branches
83	F6 3B B7	Tests dot/blank bit
86	7B	Turn Q on
87	30 B7	Go to EXECUTE
89	BA	Store D in RA.1
8A	8A	Fetch temporary bit pointer
8B	F6 33 92	Shift right and test for border cross

Listing 1 continued on page 224

Data Terminals From MICROMAIL? YES,

Because We Offer....

...A 'Personal Approach'
Towards the Quick and Efficient Handling of Your Individual Order.

...Inventory.
The Equipment You Select is Readily Available from Our Stock.

...Terminals Only.
We Specialize in Data Terminal Equipment.



DIABLO 1650

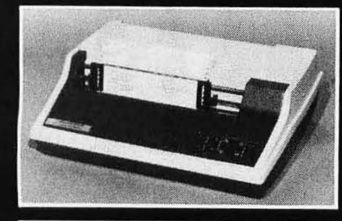
- Prints at 40 cps, using 88, 92, or 96 char. metalized printwheels.
- Vertical resolution 1/48"; Horizontal 1/120". Capable of proportional spacing, bidirectional printing, and graphics under software control.
- Bidirectional normal and direct tabs. Left, right, top and bottom margins.

R.O. $2890.00
KSR $3285.00

DIABLO 1640

- Uses plastic printwheel and prints at 45 cps. Otherwise, shares identical features with 1650 including:
  - Friction or tractor feed, up to 15" wide.
  - Cartridge ribbon, fabric or carbon.

R.O. $2745.00
KSR $3140.00

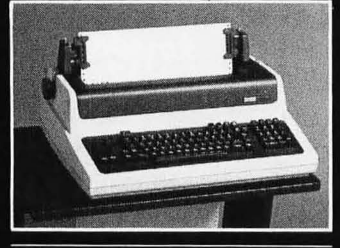


T.I. 810

- Includes upper/lower case option.
- Bidirectional printing at 150 cps.
- Tractor-feed forms, 3" to 15" wide.

$1599.00

Options:
- Forms length control — **$100.00**
- Vertical Format Control with Compressed Print — **$125.00**



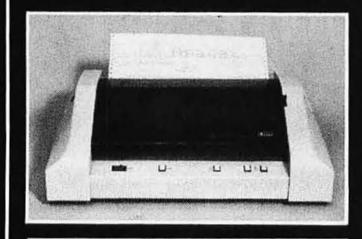
DEC LA 34

(Shown with optional forms tractor and numeric keypad).

- Prints 10, 12, 13.2, or 16.5 characters per inch, upper/lower case.
- 2, 3, 4, 6, 8, or 12 lines per inch.
- Friction feed, paper width to 15 inches.

$999.00

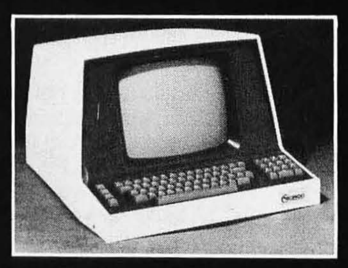
Options:
- Numeric keypad — **$80.00**
- Adjustable forms tractor — **$130.00**



ANADEX DP-9500/9501

- High Density Graphics
- Parallel, RS-232C, and Current Loop interfaces standard.
- Double width printing
- 132/175 or 132/220 columns.
- 50 to 200+ lines/min., 150/200 CPS 9 x 7/7 x 9 font or 120/200 CPS with 11 x 9/7 x 9 font.
- 9-wire print head, 650 million character life.
- Bi-Directional printing with shortest distance sensing logic.
- Adjustable width tractor paper feed.
- Complete forms control.

$1399.00



SOROC IQ 120

- Displays 80 x 24, upper/lower case.
- Separate numeric keypad and cursor keys.
- Protected fields displayed at reduced intensity.

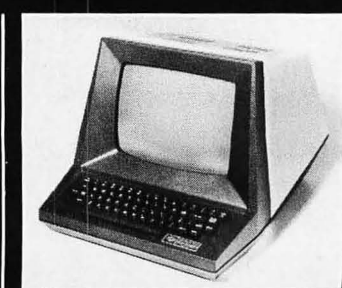
$740.00



SOROC IQ 140

- 117-key detachable keyboard with numeric cluster and cursor control.
- Insert/delete line, insert/delete character.
- Underline, blink, reverse, 1/2 intensity, protected and blank fields.
- Printer port with independent baud rate — prints line, partial or full screen.

$1130.00



TEC 510

- Reverse video, blinking, underline, 1/2 intensity, protected fields, blank security field.
- Transmit character, line, partial page, page, or unprotected data.
- Cursor up, down, left, right, return, home, plus load and read.

$699.00



TELETYPE 43

- Prints 132 columns, upper/lower case with true descenders.
- 30 character/second print speed. 110-300 baud.
- Uses 12" wide by 8.5" pinfeed paper.
- Print position scale, paper guide and supply rack.

$999.00

Write or Call In for Our Free Catalogue!



Visit MICROMAIL at the NCC-Personal Computing Festival, Booths 65-66!

TO ORDER: Send check or money order to: **MICROMAIL, P.O. Box 3297, Santa Ana, CA 92703.** Personal or company checks require two weeks to clear. Terminals in stock are shipped the business day after receipt of certified funds. All equipment includes factory warranty.

SHIPPING: We ship freight collect by UPS when possible. Larger terminals are shipped by motor freight. Air and express delivery is available on all products.

HANDLING: All orders are subject to MICROMAIL's handling charges. Less than $750.00, add 3%. $750.00 to $2,000.00, add 2%. Over $2,000.00, add 1%.

Listing 1 continued:

8E	AA					Update bit pointer
8F	9A	30	7A			Put old D back in D & return to shift & test
92	19					Increment temporary byte pointer
93	76					Shift bit back into other end of bit pointer
94	AA					Update bit pointer
95	9A	30	7A			Put old D back in D & return to shift & test
98	BA					Store D in RA.1
99	8A					Fetch temporary bit pointer
9A	FE	33	A1			Shift left and test for border cross
9D	AA					Update bit pointer
9E	9A	30	7D			Put old D back in D & return to shift & test
A1	29					Decrement temporary byte pointer
A2	7E					Shift bit back into other end of bit pointer
A3	AA					Update bit pointer
A4	9A	30	7D			Put old D back in D & return to shift & test
A7	BA					Store D in RA.1
A8	89					Fetch temporary byte pointer
A9	FC	08				Add 08 to D & put sum in D
AB	A9					Update byte pointer
AC	9A	30	80			Put old D back in D & return to shift & test
AF	BA					Store D in RA.1
B0	89					Fetch temporary byte pointer
B1	FF	08				Subtract 08 from D & put difference in D
B3	A9					Update byte pointer
B4	9A	30	83			Put old D back in D & return to shift & test
					EXECUTE	
B7	D5	D8	D6	D8		Generate one "wink" of cursor
BB	31	C0				Go to M(C0) if Q is on
BD	D6					Call DOTWRT & write on screen
BE	30	68				Go to test for clear
C0	D5					Call BNKWRT & write on screen
C1	7A					Turn Q off
C2	30	68				Go to test for clear

Text continued from page 220:

One novel effect may be produced by changing the sequence of bytes beginning at location 0046 to 01, AE, 2E, 8E. This permits the program to run at maximum speed. The cursor will streak across the screen almost too quickly for the eye to follow. As you flip the toggle switches up and down, it will paint a crazy-quilt pattern across the screen.

To clear the screen, simply hold INPUT depressed while flipping RUN up. This branches to a simple routine that writes zeroes consecutively in memory from the top of the displayed page on down.

Design Storage

Saving a design produced with the Doodler for later display involves dumping the contents of the display page of memory into some mass-storage medium. Lacking a cassette tape interface or some other storage, you will have to step through memory and write the hexadecimal contents of each byte in the page.

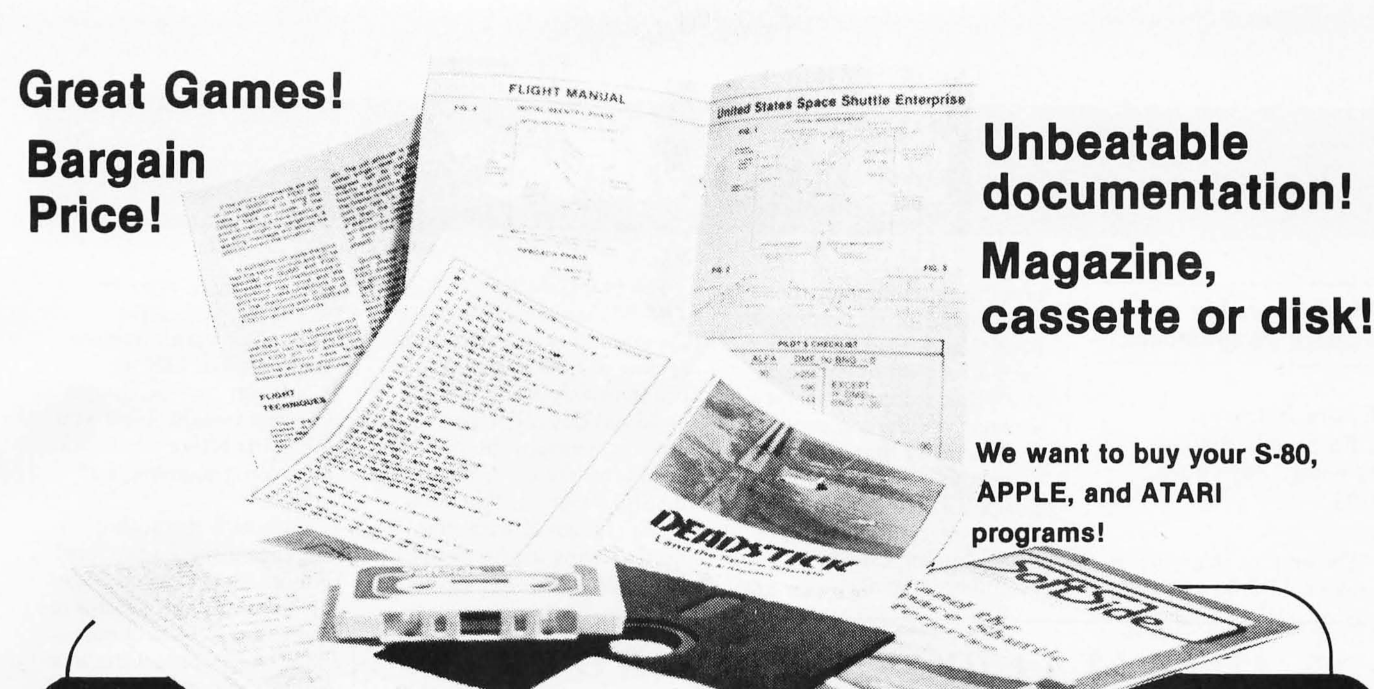
Doodle away! ■

Great Games!

Bargain Price!

Unbeatable documentation!

Magazine, cassette or disk!



We want to buy your S-80, APPLE, and ATARI programs!

SoftSide™

Now ATARI® Too!

ATARI® A Warner Communications Company

SoftSide: S-80* Edition .... 12 issues, $18., Bulk Rate: • $25., 12 issues, First Class; $39.50., 6 issues with cassette; • $69., 6 issues with diskette.

SoftSide: Apple* Edition ..... $15., 12 issues, Bulk Rate; • $22., 12 issues, First Class; • $69. 6 issues with diskettes.

SoftSide: Atari Edition .... $15., 12 issues, Bulk Rate; • $22., 12 issues First Class

PROG/80 .. Programming Methods, Utility Programs, Timesharing Section, Reviews, Hardware Projects, $15. 6 issues, Bulk Rate, • $21. 6 issues, First Class.

USE YOUR MASTERCHARGE OR VISA AND CALL **TOLL-FREE 1-800-258-1790**

(In NH call 673-5144) SoftSide Publications, P.O. Box 68, Milford, NH 03055

Buy SoftSide at these dealers:

Datel Systems
1211 Ave. of Americas
New York, N.Y. 10036

Personal Computer
South 104 Freya Suite 104
Spokane, WA 99202

Computerland
1500 S 336 St.
#12 Parkway Center
Federal Way, WA 98003

Byte Shop
6019 W. Layton
Greenfield WI 53220

Computerland
10111 W. Capitol Dr.
Milwaukee, WI 53222

Team Elect.
2321 E. Claire
Eau Claire, WI 54701

Ye Old Computer Shop
1301 George Washington Way
Richland, WA 99352

Camera & Computer Emporium
921 Southwest Morrison
Portland, OR 97205

Neighborhood Computer Store
13045 W. Alameda
Lakewood, CO 80215

Camera & Computer Emporium
16144 SE McLoughlin
Milwaukee, OR 97222

Byte Shop Computer Store
6041 Greenback Ln.
Citrus Hgts, CA 95610

Santa Rosa Computer Center
604 7th Street
Santa Rosa, CA 95454

Computerland
611 5th St.
Santa Rosa, CA 95404

Computerland
1077 Saratoga Sunnyvale Rd
San Jose, CA 95129

Micro Sun Computer Center
2989 N. Main
Walnut Creek, CA 94596

Computerland
6743 Dublin Blvd
Dublin, CA 94566

Byte Shop
1122 B St.
Hayward, CA 94541

Computerland
11074 San Pablo Ave.
El Cerrito, CA 94530

Computerland
4546 El Camino Real
Los Altos, CA 94022

Byte Shop
123 Yorba Linda Blvd.
Placentia, CA 92670

Computerland
289 E. Highland Ave.
San Bernardino, CA 92404

Computerland
4233 Convoy
San Diego CA 92111

Byte Shop
8038 Clairemont Mesa Blvd.
San Diego, CA 92111

Computerland
171 E. Thousand Oaks Bld #1
Thousand Oaks, CA 91360

Computers Are Fun
2268 Westwood Blvd.
Los Angeles, CA 90064

Computerland
3152 E. Camelback Rd.
Phoenix, AZ 85016

Computer Room
1515 S. 150E
Salt Lake City, UT 84105

Byte Shop
6019 W. Layton
Greenfield, WI 53220

Byte Shop
3464 S. Acoma
Eaglewood, CO 80110

Computerland
1537 Howe Ave. #106
Sacramento, CA 95825

Computerworks
Liberty Plaza
1439 Post Rd E
Westport, CT 06880

Computers Plus
6120 6120 Franconia Rd.
Alexandria, VA 22310

Computerland
1520 E. Fowler Ave.
Tampa, FL 33612

Compu Shop Dallas
N. Central Espy
Dallas, TX 75234

Computerland of South Bay
16720 Hawthorne Blvd.
Lawndale, CA 90260

Computer Store
820 Broadway
Santa Monica, CA 90401

Computer Metrics Inc
1251 Broadway
El Cajon, CA 92021

Computerland
4546 El Camino Real
Los Altos, CA 94022

Capitol Computer Systems
3396 El Camino Ave.
Sacramento, CA 95821

Computer Haven
6 South St.
Milford, NH 03055

*TRS-80 is a trademark of Radio Shack and Tandy Corp. *Apple is a registered trademark of Apple Computer Co.

Circle 138 on inquiry card.

Book Reviews

TRS-80 Assembly Language Programming

William Barden Jr
Radio Shack, 1979
224 pages, softcover
$3.95

"The goal of this book is to take a TRS-80 user familiar with some of the concepts of programming in BASIC and introduce him to TRS-80 assembly language." With that statement in the preface, Mr Barden proceeds to do exactly that. He introduces the user of the Radio Shack TRS-80 computer to that mysterious element of programming called assembly language.

For you old-timers, *TRS-80 Assembly Language Programming* is a refreshing review of how we used to program way back in the good old days. For you novices, perhaps discouraged after trying to debug a BASIC program, this book is the change of pace you need. Throw away, or at least put aside, that BASIC user's manual, type in "SYSTEM" when the prompt character appears, and load that Editor/Assembler or TBUG tape you just bought. Now you are going to see what computer programming is all about!

Although the author states that the Radio Shack Editor/Assembler package or its equivalent is not a requirement, you will miss half the fun of reading this book if you do not have it. Also, TBUG is recommended by the author in order to fully appreciate some material.

Barden has developed a unique presentation to introduce and explain the general concepts of the TRS-80 assembly language, the mnemonic system for the Z80 microprocessor. I say a unique presentation because this is the first assembly-language book which I have enjoyed reading. Barden is not averse to injecting a little humor into his writing. After all, who says that programming books should be all bits, bytes, and syntax restrictions?

Barden begins with the architecture of the Z80, its instruction set, and its addressing modes. He then proceeds through the Editor/Assembler and the TBUG commands and formats in the first section of the book.

There is quite a bit of information packed within these first eighty-four pages, and it pays to read through Section 1 with a highlighting marker in hand. In fact, I skimmed through these pages for my first reading and then reread them more carefully the second time. This method tends to fix certain important details in your mind and will act as a referencing tool.

After you feel confident with the introductory material, move on to Sec-

MULTI-USER OASIS HAS THE FEATURES PROS DEMAND. READ WHY.

(THEN COMPARE.)

Computer experts (the pros) usually have big computer experience. That's why when they shop system software for Z80 micros, they look for the big system features they're used to. And that's why they like Multi-User OASIS. You will too.

DATA INTEGRITY: FILE & AUTOMATIC RECORD LOCKING

The biggest challenge for any multi-user system is co-ordinating requests from several users to change the same record at the same time.

Without proper co-ordination, the confusion and problems of inaccurate or even destroyed data can be staggering.

Our File and Automatic Record Locking features solve these problems.

For example: normally all users can view a particular record at the same time. But, if that record is being updated by one user, automatic record locking will deny all other users access to the record until the up-date is completed. So records are always accurate, up-to-date and integrity is assured.

Pros demand file & automatic record locking. OASIS has it.

SYSTEM SECURITY: LOGON, PASSWORD & USER ACCOUNTING

Controlling who gets on your system and what they do once they're on it is the essence of system security.

Without this control, unauthorized users could access your programs and data and do what they like. A frightening prospect isn't it?

And multi-users can multiply the problem.

But with the Logon, Password and Privilege Level features of Multi-User OASIS, a system manager can specify for each user which programs and files may be accessed—and for what purpose.

Security is further enhanced by User Accounting—a feature that lets you keep a history of which user has been logged on, when and for how long.

Pros insist on these security features. OASIS has them.

EFFICIENCY: RE-ENTRANT BASIC

A multi-user system is often not even practical on computers limited to 64K memory.

OASIS Re-entrant BASIC makes it practical. How?

Because all users use a single run-time BASIC module, to execute their compiled programs, less memory is needed. Even if you have more than 64K, your pay-off is cost saving and more efficient use of all the memory you have available—because it services more users.

Sound like a pro feature? It is. And OASIS has it.

AND LOTS MORE...

Multi-User OASIS supports as many as 16 terminals and can run in as little as 56K memory. Or, with bank switching, as much as 784K.

OASIS IS AVAILABLE FOR: Altos; Bell Controls; Billings; Compucorp; Cromemco; Corvus; Delta Products; Digital Group; Digital Microsystems; Dynabyte; Godbout; IBC; Industrial Microsystems; Konan; Micromation; Micropolis; North Star; Onyx; SD Systems; Tarbell; Thinkertoys; TRS 80 Mod. II; Vector Graphic Vorimex; X Comp; and others.

Multi-Tasking lets each user run more than one job at the same time.

And there's our BASIC—a compiler, interpreter and debugger all in one. An OASIS exclusive.

Still more: Editor; Hard & Floppy Disk Support; Keyed (ISAM), Direct & Sequential Files; Mail-Box; Scheduler; Spooler; all from OASIS.

Our documentation is recognized as some of the best, most extensive, in the industry. And, of course, there's plenty of application software.

Put it all together and it's easy to see why the real pros like OASIS. Join them. Send your order today.



CIRCLE WHAT YOU WANT

Product	Price with Manual	Manual Only
OPERATING SYSTEM (Includes: EXEC Language; File Management; User Accounting; Device Drivers; Print Spooler; General Text Editor; etc.)		
SINGLE-USER	$150	$17.50
MULTI-USER	350	17.50
BASIC COMPILER/ INTERPRETER/DEBUGGER	100	15.00
RE-ENTRANT BASIC COMPILER/INTERPRETER/ DEBUGGER	150	15.00
DEVELOPMENT PACKAGE (Macro Assembler; Linkage Editor; Debugger)	150	25.00
TEXT EDITOR & SCRIPT PROCESSOR	150	15.00
DIAGNOSTIC & CONVERSION UTILITIES (Memory Test; Assembly Language; Converters; File Recovery; Disk Test; File Copy from other OS; etc.)	100	15.00
COMMUNICATIONS PACKAGE (Terminal Emulator; File Send & Receive)	100	15.00
PACKAGE PRICE (All of Above)		
SINGLE-USER	500	60.00
MULTI-USER	850	60.00
FILE SORT	100	15.00
COBOL-ANSI '74	750	35.00

Order OASIS from:
Phase One Systems, Inc.
7700 Edgewater Drive, Suite 830
Oakland, CA 94621
Telephone (415) 562-8085
TWX 910-366-7139

NAME ______
STREET (NO BOX #) ______
CITY ______
STATE ______ ZIP ______
AMOUNT $ ______
(Attach system description; add $3 for shipping; California residents add sales tax)
☐ Check enclosed ☐ VISA
☐ UPS C.O.D. ☐ Mastercharge
Card Number ______
Expiration Date ______
Signature ______

tion 2. Barden not only explains the how and the why of assembly language, but does so with useful examples of assembly-language coding. When he explains how to move data, he does it by coding the instructions and discussing the pertinent background. Arithmetic and comparison operations, logical and bit operations, shifting, strings, and tables are explained and presented with appropriate coding. If you have TBUG or Editor/Assembler, you can code along with the text and actually see the operations being executed. This interactive approach works well.

In *TRS-80 Assembly Language Programming*, Barden handles the discussion of input/output (I/O) operations in an easily readable, yet informative fashion. After you complete this phase of your education, the mystery of assembly language magically evaporates, and you are ready to tackle some sophisticated assembly-language programming.

But that's not all. Barden ties together most of the loose threads by including some interesting and useful subroutines. If you want a quick routine to fill a block of memory with any given 8-bit value or move the contents of a block of memory from one area to another, you need only assemble the subroutines already coded for you and presented in the book.

Some arithmetic subroutines are also given: adding or subtracting operands containing up to 256 bytes, and multiplying or dividing 16-bit numbers. The compare subroutine is useful since it compares two 8-bit operands in true algebraic fashion. A routine for converting an 8-bit value into two American Standard Code for Information Interchange (ASCII) characters is included, as is a search subroutine. Finally, three subroutines that operate in a manner similar to the SET, RESET, and POINT statements in BASIC are given in the book.

Barden offers four complete assembly-language programs to start your program library off on the right foot. These perform the functions of writing data to the screen (good for looking at the contents of memory locations), moving patterns at high speed (great for animated graphics), a graphic bubble sort (good for demonstrations), and a program to play music via the cassette output port.

The appendices include a listing of the Z80 instruction set and a listing of the Z80 op codes. (For quick reference to Z80 mnemonics, Zilog offers the *Z80-CPU Programming Reference Card*, which I have found more convenient to use than flipping through the pages of a book.)

One further note: William Barden is also the author of *The Z80 Microcomputer Handbook* (Howard W Sams Co Inc, 1978), which takes the Z80 software a few steps deeper into the assembly-language forest.

So, what can you get for $3.95 in addition to Barden's excellent introductory text dealing with Z80 assembly-language programming? Quite possibly you will get a hard-to-shake bite from the assembly-language bug. ■

Len Gorney
Box 91 RR 5
Salisbury Rd
Clarks Summit PA 18411

Clubs and Newsletters

Newsletter for Ohio Scientific Users

The OSI Users' Independent Newsletter is edited, published, and written by Charles Curley, 6061 Lime Ave, Number 2, Long Beach CA 90805. A year's subscription is $10 for six issues. The newsletter includes articles on software, hardware, bugs and fixes, and reviews of items of interest to OSI users. Articles are welcome from enthusiastic owners and users.

Salem, Oregon Area Computer Club

Club membership is open to all those that are interested in using microcomputers for fun and business. Membership dues are $5 per year. The club meets the first Monday of each odd-numbered month at McKinley Community School, 461 McGilchrist St, Salem, Oregon. On even-numbered months, they meet at Computer Pathways Unltd Retail Store, 831 Lancaster Dr, Salem, Oregon. A monthly newsletter is published. Each meeting features a presentation by a club member or invited guest. For information, contact Salem Area Computer Club, c/o Doug Walker, 4554 Jan Ree Dr NE, Salem OR 97303.

North London Hobby Computer Club (NLHCC)

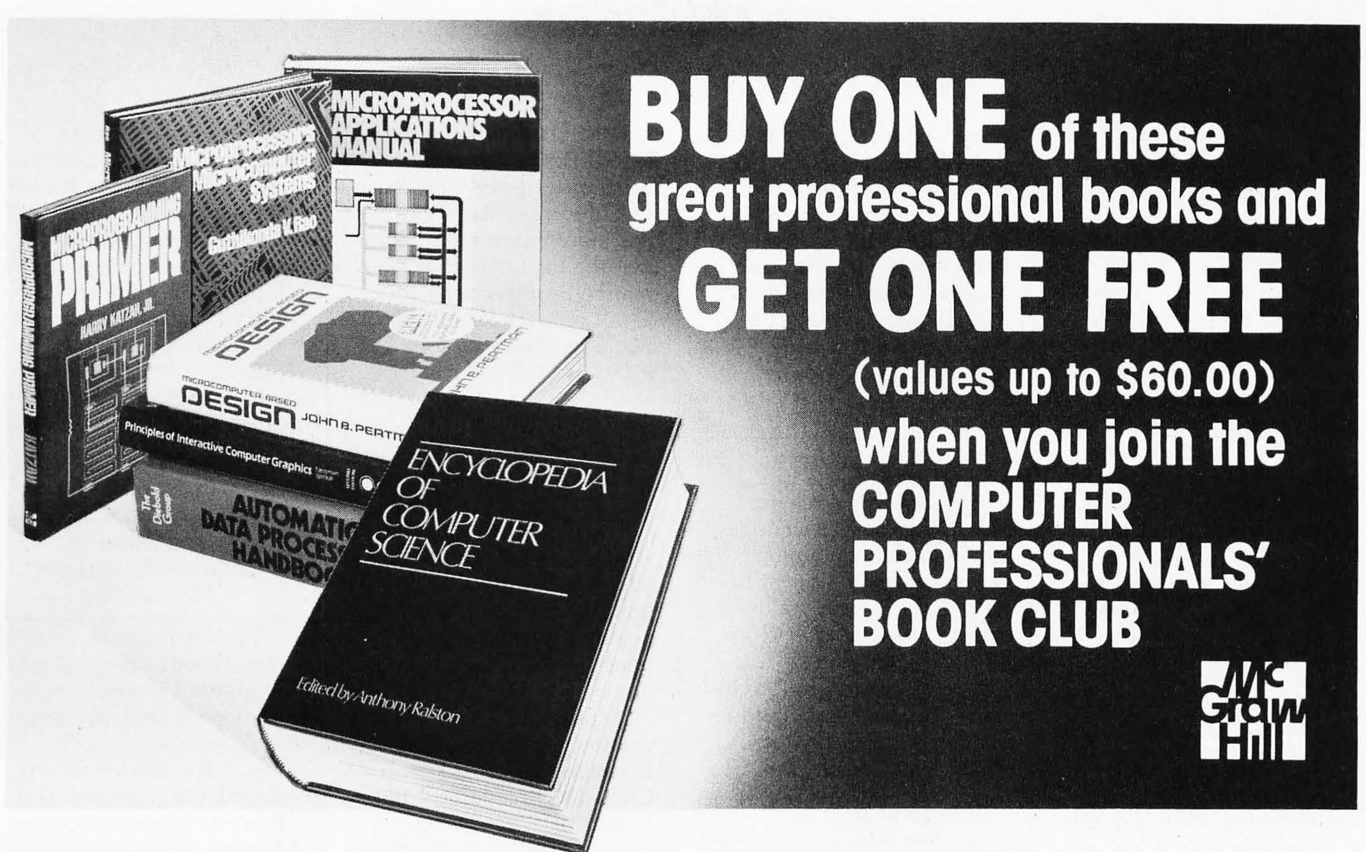
The NLHCC has scheduled their meetings for the next 3 months. The theme for the May meeting is "Computer-Aided Instruction." The meeting will be held May 7 at 7 PM in the Students Common Room in the Polytechnic of North London. On June 4, the meeting is entitled "The House Computer." July third's meeting is on "The Personal Computer and Restel/Teletext." Contact NLHCC, Holloway, London N7 8DB, ENGLAND.

TRS-80 Users Group of Sacramento

The TRS-80 users group of Sacramento meets at the Sacramento Country Branch Library, 2443 Marconi Blvd (Marconi and Fulton), Sacramento, California, from 7 to 10 PM as called. For more information, contact the TRS-80 Users Group of Sacramento, POB 255704, Sacramento CA 95825.

University of New Hampshire Computer Services Newsletter

On Line is a well-produced newsletter covering software programs, schedules of events and other activities of interest to students in the computer programs. For more information, contact Computer Services, University of New Hampshire, Kingsbury Hall, Durham NH 03824.



Choose any one of these books at the special club discount, and select any other as your gift Free of Charge when you enroll:

AUTOMATIC DATA PROCESSING HANDBOOK Edited by The Diebold Group, Inc.
168/075 Pub. Pr., $38.95 Club Pr., $25.75

PROGRAMMING LANGUAGES By A. B. Tucker, Jr.
654/158 Pub. Pr., $22.00 Club Pr., $16.50

MINICOMPUTER SYSTEMS, 2nd Ed. By R. H. Eckhouse
787/026 Pub. Pr., $21.95 Club Pr., $16.50

MICROCOMPUTERS/MICROPROCESSORS: Hardware, Software & Applications By J. L. Hilburn & P. N. Julich
771/499 Pub. Pr., $22.50 Club Pr., $16.50

MICROPROCESSOR APPLICATIONS MANUAL By Motorola, Inc.
435/278 Pub. Pr., $38.00 Club Pr., $26.50

THE 8080A BUGBOOK: MICROCOMPUTER INTERFACING AND PROGRAMMING By P. R. Rony, D. G. Larsen & J. A. Titus
783/845 Pub. Pr., $9.95 Club Pr., $8.45

MICROCOMPUTER-BASED DESIGN By J. Peatman
491/380 Pub. Pr., $26.50 Club Pr., $18.95

DATA BASE DESIGN By G. Wiederhold
701/30X Pub. Pr., $24.50 Club Pr., $18.25

PRINCIPLES OF INTERACTIVE COMPUTER GRAPHICS, 2nd Ed. By W. M. Newman & R. F. Sproull
463/387 Pub. Pr., $24.95 Club Pr., $19.95

PROGRAMMING FOR MINICOMPUTERS By J. C. Cluley
785/49X Pub. Pr., $17.50 Club Pr., $13.50

REAL-TIME PROGRAMMING WITH MICROCOMPUTERS By R. C. Turner
786/372 Pub. Pr., $16.95 Club Pr., $13.95

MEMORY DESIGN: Microcomputers and Mainframes By Electronics Magazine
191/549 Pub. Pr., $18.50 Club Pr., $15.50

HOW TO DESIGN AND BUILD YOUR OWN CUSTOM TV GAMES By D. L. Heiserman
786/585 Pub. Pr., $14.95 Club Pr., $11.95

HANDBOOK OF OPERATIONAL AMPLIFIER CIRCUIT DESIGN By D. F. Stout, edited by M. Kaufman
617/97X Pub. Pr., $29.95 Club Pr., $17.50

ANALOG SYSTEMS FOR MICROPROCESSORS AND MINICOMPUTERS By P. H. Garrett
786/496 Pub. Pr., $18.95 Club Pr., $14.95

ENCYCLOPEDIA OF COMPUTER SCIENCE Edited by A. Ralston & C. L. Meek
769/01X Pub. Pr., $60.00 Club Pr., $39.95

MICROPROCESSOR AND MICROCOMPUTER SYSTEMS By G. V. Rao
783/659 Pub. Pr., $24.50 Club Pr., $19.50

THE Z-80 MICROCOMPUTER HANDBOOK By W. Barden, Jr.
784/914 Pub. Pr., $8.95 Club Pr., $7.60

Why YOU should join now!

• BEST BOOKS IN YOUR FIELD—Books are selected from a wide range of publishers by expert editors and consultants to give you continuing access to the latest books in your field.

• BIG SAVINGS—Build your library and save money too! We guarantee savings of at least 15% off publishers' list prices on every book. Usually 20%, 25% or even higher!

• BONUS BOOKS—You will *immediately begin to participate in our Bonus Book Plan that allows you savings between 70-80%* off the publisher's price of many books.

• CONVENIENCE—14 times a year you receive the Club Bulletin FREE, fully describing the Main Selection and alternate selections, together with a dated reply card. If you want the Main Selection, you simply do nothing—it will be shipped automatically. If you want an alternate selection—or no book at all—you simply indicate it on the regular reply card and return it by the date specified. You will have at least 10 days to decide. If, because of late mail delivery of the Bulletin you should receive a book you do not want, just return it at the Club's expense.

As a Club member, you agree only to the purchase of four books (including your first selection) over a two-year period.

See us at NCC, booth 1215

Computer Professionals' Book Club
P.O. Box 582, Hightstown, New Jersey 08520

Please enroll me as a member and send me the two books indicated, billing me for my first selection only at the discounted member's price, plus local tax, postage and handling. If not satisfied, I may return the books within 10 days and my membership will be canceled. I agree to purchase a minimum of 3 additional books during the next 2 years as outlined under the club plan described in this ad. Membership in the club is continuous but cancellable by me any time after the four book purchase requirement has been fulfilled.

Write Code # of FREE selection here	Write Code # of FIRST selection here

Orders from outside the U.S. must be prepaid with international money orders in U.S. dollars.

Charge my ☐ VISA ☐ MASTER CHARGE* Exp. Date ____

Credit Card # ____ *MC Bank # ____

Signature ____

Name ____

Address ____

City, State, Zip ____

Corporate Affiliation ____

This order subject to acceptance by McGraw-Hill. All prices subject to change without notice. Offer good only to new members. A postage and handling charge is added to all shipments.

P39458

Central Oklahoma Amateur Computing Association (CENOACA)

CENOACA meets the second Saturday of each month at the OSU Technical Institute, 900 N Portland, Oklahoma City, Oklahoma, at 10 AM. Their purpose is to acquaint beginners with personal computing and increase their knowledge of special interest areas, including SwTPC and 6800 systems. Their newsletter, *CENOACA Newsbits*, is published on an irregular basis. Contact CENOACA, POB 2213, Norman OK 73070.

Another Group in Florida

The Space Coast Microcomputer Club meets on the fourth Thursday of each month at 7:30 PM in the Merritt Island Public Library Auditorium. They are affiliated with the JF Kennedy Space Center at Cape Canaveral. The group publishes *Enterprise*, a monthly newsletter. The primary interests are Z80, 8080, and S-100 systems. Dues are $5 per year, and inquiries should be sent to Ray O Lockwood, 315 Inlet Ave, Merritt Island FL 32952.

APL Newsletter

A quarterly newsletter describing tools, techniques, services, and containing general news of interest to APL users, is being published by Southwater Corp, 2348 Whitney Ave, Mt Carmel CT 06518. Subscriptions are $6 annually and requests should be sent to *APL Market Newsletter*, at the above address.

Newsletters on the UCSD Pascal System

The Institute for Information Systems is publishing newsletters describing the UCSD Pascal System developed by the University of California, San Diego. For more information, contact the Institute for Information Systems, mail code C-021, University of California, San Diego, La Jolla CA 92093.

Apple Users Group

The Goldcoast Computer Apple II Users Club desires additional members. The group publishes a monthly newsletter with programming tips, and they have a library selection of over 1000 programs. Send for details: Florida's Goldcoast Computer Apple II Users Club, 133 Brenda St, Milton FL 32570.

Feedback From Fujitsu

Feedback From Fujitsu is a newsletter from Fujitsu Limited, Japan's largest computer manufacturer. It contains items concerning discoveries and general business news of Japan's strides in the computer industry. For more information, contact *Feedback From Fujitsu*, Ruder and Finn Inc, 110 E 59th St, New York NY 10022.

Association for Computers and the Humanities

This international organization is devoted to the study of computer applications in language and literary studies, history, musicology, the visual arts, cultural anthropology, and other related social sciences. Members of the association are entitled to discount at the International Conference on Computers and the Humanities and the meetings of the Association for Literary and Linguistic Computing. The annual dues are $15, and a quarterly newsletter is available for $15 per year. For details, write Association for Computers and the Humanities, Queens College, Flushing NY 11367.

Computers and Gambling Magazine

This quarterly magazine is oriented toward computer hobbyists interested in using computers for all types of handicapping systems, card counting systems, and techniques for stock and future markets investments. Articles describe products and techniques for the computerized gambler, and advertising of products and personal computers is included. Sample issues are available for $1. Subscriptions are $5 per year and may be obtained by writing to Joe Computer, 22713 Ventura Blvd, Suite F, Woodland Hills CA 91364. ■

Circle 145 on inquiry card.

Observations from BYTE's Ongoing Monitor Box, The BOMB

As the card says, BYTE's BOMB is your direct line to the editor's desk. Ever since the third issue of BYTE (November 1975), BYTE's editors have used the BOMB as an important source of information on how readers react to our magazine. Therefore we thank the readers who have mailed the BOMB card to us and included their comments.

Occasionally we like to share with you some of the more interesting responses received on these cards. The most pictorial BOMB card in recent memory came from a reader in Hackensack, New Jersey, shown front and back in photos 1 and 2. It seems our friend in New Jersey was generally pleased with our January 1980 issue.

Regretfully not all of our readers have been as well pleased. On one February 1980 BYTE BOMB card most of the articles were rated as being of poor quality, and a single word appeared in the "Comments" section: "PHOOEY." Yet another BOMB card for February said: "Your best issue in my 3 years!!" Clearly, a split decision.

If you have wondered when we stop accepting BOMB cards for a given issue, we cut off tabulation during the second week of the month after the cover date of an issue.

If you have never sent in a BOMB card, but intend to do so, please observe the following points. The card should be sent to our offices in Peterborough, New Hampshire. The card is presently not postpaid, but $0.10 US postage will suffice for most readers. The card is intended to record your subjective opinion, so just write your reaction, and put any specific comments on the bottom of the card. You are free to remain anonymous, but you may put your name and address on the card if you wish. In any case, letting us know your responses to our work helps us to work better. . . .**RSS**

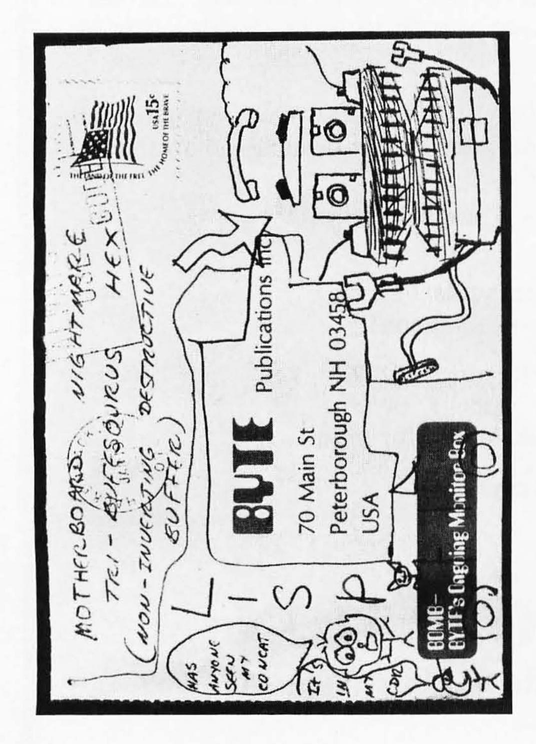


Photo 1

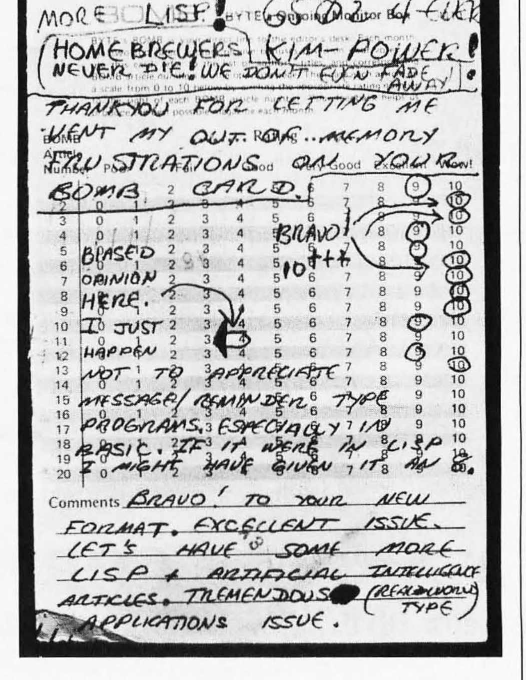


Photo 2

The Largest Computer Store in America?

What is the largest personal computer store in America? The answer to that question is debatable, but on the East Coast, it's probably NEECO's (New England Electronics Company Incorporated) new facility in Needham, Massachusetts. The 9000-square-foot showroom was filled with a variety of hardware and software on our recent visit. President Robert Crowell told us about their new nationwide distribution subsidiary, called Microamerica, which was announced last fall and carries most of the major computer product lines.

We have noticed a marked increase in the number of large computer stores like Bob Crowell's with diverse product lines. This supermarket-like approach can be beneficial to the industry when combined with personal service to customers—a vital ingredient to any store's success.

In the West, things are also humming in the personal computer store field. Micro-Age in Tempe, Arizona, is a good example. Run by Jeff McKeever and Alan Hald, Micro-Age has been expanding. We were favorably impressed by their facility and by their approach to the market during a recent visit. . . .**CM**

Texas Instruments Has an Award Winning Bubble Memory

Texas Instruments has been awarded the 1979 Information Product of the Year Award for its Model 763 Bubble-Memory Data Terminal and Model 765 Portable Bubble-Memory Data Terminal. Both terminals have a full, 128-character, alphanumeric keyboard. Up to 80,000 characters can be collected and stored in the nonvolatile bubble memory, then transmitted at rates from 110 to 9600 bits per second (bps) to a host computer system. Both units have a quiet 30-character-per-second (cps) print speed and built-in acoustic coupler modem.

A bubble memory is a small electromagnetic circuit that stores digital information by changing the magnetic polarity of a thin, crystalline film. The bubbles are cylindrical magnetic islands polarized in a direction opposite from that of the film. Bubble memory has no moving parts, and, because it works magnetically, retains information when the power is turned off. It offers higher access

speeds, smaller size, and less weight and power consumption over paper-tape, cassette and floppy-disk systems. Bubble memory terminals can access any indexed record in memory in less than 15 ms (ie: 10 times faster than a floppy disk). If the data location is unknown, the character-string-search speed is 1000 cps, about 4 times the speed of a cassette search.

For more information, contact Texas Instruments, POB 1444, M/S 7784, Houston TX 77001.

The Fifth Annual California Computer Swap Meet

The Fifth Annual California Computer Swap Meet will be held on June 1, 1980, from 10 to 6 PM at the Santa Clara County Fairgrounds (344 Tully Rd, San Jose CA). Last year's event, held in September at the San Mateo County Fairgrounds, was attended by over 3000 buyers.

Personal computing hardware and software will be sold by individuals, computer manufacturers, and computer stores. New software and hardware, as well as used, will be offered by vendors and individuals who have cleaned out their back rooms and garages for the event. Admission is free to buyers. Contact the Fifth California Computer Swap Meet, POB 52, Palo Alto CA 94302, or call 415-324-2404.

Inexpensive Communications Via Meteor Trails

The hundreds of millions of meteors that enter the earth's atmosphere every day leave in their wake a very inexpensive communications medium—the meteor trail. This band of ionized particles is an effective alternative to satellites for communication. Meteor trails can be used to relay data concerning icebergs, pollution, earthquakes, and oil reserves, and can link remote villages with distant sources of supplies and emergency assistance.

Meteor burst transmission has proven reliable and cost-effective for the snow telemetry program operated by the US Department of Agriculture's Soil Conservation Service. By transmitting snowfall data from remote locations, the program has eliminated costly manual measurements.

Meteor burst transmission systems work in several stages. Remote sensors gather data while a microprocessor-controlled station emits a continuous radio signal, which bounces off a meteor trail whenever one occurs within range. When this signal reaches a transceiver at a remote site, data is transmitted via the meteor trail to the central station.

For more information, contact SRI International, 333 Ravenswood Ave, Menlo Park CA 94025. ■

BYTE's Bugs

Escher's Nationality

I was interested in the February 1980 BYTE cover and in Carl Helmers' editorial concerning the Euler Problem of Königsberg. I immediately noticed when I received the issue the similarity of the cover painting to Escher's work. However, I must take argument concerning the statement that Escher was a Swiss artist.

Maurits C Escher was born on June 17, 1898 in Leeuwarden, *Netherlands*, and died March 27, 1972 in Laren, also in the Netherlands. He was in fact a *Dutchman* whose works are almost revered today in the Netherlands. I certainly commend artist Robert Tinney for combining two of Escher's more famous prints *Drawing Hands*, from January 1948, and *Reptiles*, from March 1943. However, the sequence of reptiles in Escher's original work came around and completed the cycle, by returning to the flat paper, whereas these "dragons" seem to disappear around the corner.

Naturally, the Towers of Hanoi did not go unnoticed either.

My commendation to Mr Tinney, but I think that the history of Escher, who may have been the world's greatest graphic artist, should be given correctly.

Neal Koss
3440 Lomita Blvd
Suite 452
Torrance CA 90505

Event Queue

MAY 1980

May and June

Microprocessor Training Courses, Cudham Hall, Cudham, Sevenoaks, Kent, ENGLAND. Microprocessor familiarization, microprocessor applications for the equipment user and for the manufacturer, and microprocessor-based equipment design and development are the courses being offered by the Sira Institute Limited. Write to Conference and Courses Unit, Sira Institute Ltd, South Hill, Chislehurst, Kent BR7 5EH ENGLAND.

May 1-2

Programming Language Technology and Ada, San Francisco CA. Conducted by Anthony Wasserman, the conference will discuss concepts of programming languages including those which support Ada language definition and development activity. The course costs $450. Registration information is available from Software Research Associates, POB 2432, San Francisco CA 94126.

May 5-7

Software Principles for Management, San Francisco CA. The course is intended for managers who need to understand what software is and how to utilize it properly. Registration is $675, and additional information is available from Technology Transfer Institute, POB 49765, Los Angeles CA 90049.

May 5-7

Data Communications, George Washington University Library, 2130 H St. NW, Washington DC. This course is intended to highlight major data communication services available, the basic choices in designing a data communications network, and essential engineering aspects of data communications. It is intended for systems analysts, engineers and managers. Contact the Director, Continuing Engineering Education, George Washington University, Washington DC 20052. The course fee is $510.

May 6-10

The Eighth Annual Canadian Association for Information Science, Toronto, CANADA. Technology, commodity, and rights are the themes of this conference. Topics will cover information in the marketplace, information transfer and policy issues, right to access, new information technologies and applications, and other subjects. For more information, contact the Program Chairman, Eighth Annual CAIS Conference, Technical Information Centre, Bell Northern Software Research, 12th Floor, 522 University Ave, Toronto, Ontario M5G 1W7 CANADA.

In order to gain optimal coverage of your organization's computer conferences, seminars, workshops, courses, etc, notice should reach our office at least three months in advance of the date of the event. Entries should be sent to: Event Queue, BYTE Publications, 70 Main St, Peterborough NH 03458. Each month we publish the current contents of the queue for the month of the cover date and the two following calendar months. Thus a given event may appear as many as three times in this section if it is sent to us far enough in advance.

we have the largest selection of TRS-80*, APPLE* and ATARI* software, anywhere!

For more details, send $1. (refundable toward your first purchase) for our complete software catalog!

TRS-80*

Accts Rec II Disk 32K	69.95
Adv Pers Fin Disk	24.95
Adventure Sample = 0	5.95
2 Adventures on Disk	24.95
☐ Land & Pirate	
☐ Mission & Voodoo	
☐ Count & Odyssey	
☐ Fun House & Pyramid	
3 Adventures Disk	39.95
☐ Land Pirate Mission	
☐ Count Voodoo Odyssey	
Adventures on tape	14.95
☐ Count	
☐ Fun House	
☐ Land	
☐ Mission Impossible	
☐ Pirate's Cove	
☐ Pyramid of Doom	
☐ Strange Odyssey	
☐ Voodoo	
Adventure (Microsoft)	29.95
Air Raid	9.95
Alien Invasion (sound)	cass. 9.95
Alien Invasion (sound)	disk 14.95
Amateur Radio Disk	24.95
Amazin' Mazes	7.95
Android Nim (sound)	14.95
APL	disk 34.95
APL	w/book 49.95 + $3
APL	tape 14.95
APL	book only 15.50 + $3
Appointment Log	9.95
Automated Disk Directory	14.95
Barricade	9.95
Basic Handbook	14.95 + $1
Basic Statistics	9.95
Basic Styles Handbook	5.95 + $1
Bee Wary (sound)	14.95
Binders	4.95 + $1
Biorhythms	4.95
Bridge Challenger	14.95
Cassettes	
☐ C-10	10 for 6.50 + $1
☐ C-20	10 for 7.50 + $1
Casino Anthology	7.95
Challenge (sound)	9.95
Chess Companion	7.95
COMPROC Command Processor	tape for disk only $19.95
Cribbage	7.95
Data Management System (CCA)	79.95 + $2
Diskettes	
BASF	☐ 5 for 24.95 + $1
	☐ 10 for 39.95 + $1
	☐ 20 for 69.95 + $2
	☐ 100 for 299.00 + $3
Dysan	box of 5 29.95 + $1
Dynamic Data Base	39.95
Diskette Storage Box	5.00 + $1
Dosort 32K or 48	tape 34.95
DSM Sort Utility for disk	75.00
Editor/Assembler Plus 16K	tape 29.95
Electric Pencil	tape 100.00
Electric Pencil	disk 150.00
Educator Assistant	9.95
8080-Z80 Conversion	14.95
Electronics Assistant	9.95
End Zone II	9.95
Fastgammon	19.95
File Manager 80	49.95
Floppy Armour	box of 5 4.95 + $1
Floppy Disk Diagnostic	24.95
Fortran/Assembler	150.00 + $5
Fortran	80.00 + $2.50
Assembler	80.00 + $2.50
Galactic Empire	14.95
Galactic Trader	14.95
Galactic Empire/Trader	disk 29.95
GSF 16K,32K,48K	24.95
Ham Radio	9.95
Ham Radio Advanced Version 32K	disk 24.95
Histograph/Scattergram	9.95
Home Financial Management	9.95
I Ching Level II 16K	7.95
Infinite BASIC by Racet	49.95
Business add-on	29.95
Intro TRS-80 Graphics	7.95 + $1
Inventory II.3 Disk	79.95
Inventory S	tape 24.95
Inventory S disk	w/invoicing 59.95
	w/o/invoicing 39.95
Journey Center Earth	7.95
Kamikaze	7.95
Keyboard	9.95
Kriegspell	7.95
KVP	24.95
KVP on Disk	29.95
KVP 232	24.95
Learning Level II	15.95 + $1
Level I in Level II	14.95
Level III BASIC	49.95
Life Two (sound)	14.95
Loan Amortization	19.95
Lost Dutchman's Gold	9.95
Machine Lang. Mon. (RSV.2)	26.95
Machine Lang. Mon. (RSV.2D)	29.95
Magic Paper Calculator	14.95
Mail List II Disk	99.95
Mastermind	7.95
Mastermind II	14.95
Mean Checkers Machine	tape $19.95
Mean Checkers Machine	disk 24.95
Microchess 1.5	19.95
Microsoft Editor/Assembler Plus	29.95
Micro Tax I	tape 25.00 + $2
Micro Tax II	tape 35.00 + $2
Micro Tax III	tape 50.00 + $2
Microtext Editor	9.95
Mortgage Calculator	3.95
Moving Signboard	9.95
NEWDOS	49.95
NEWDOS +	99.95
NEWDOS 80	149.95
9 Games/Preschool Child	9.95
Numerology 32K	disk 14.95
On-Line Invoicing	disk 39.95
Pathways Through the ROM	19.95
Payroll Disk 32K	39.95
Pencil Pal	35.00
Pentominoes (sound)	7.95
Periodical Cross Reference	tape 14.95
Periodical Cross Reference	disk 19.95
Personal Finance	9.95
Pigskin	9.95
Pork Barrel	9.95
PR Dogfight	7.95
Preflight	20.00
Print Spooler	disk 24.95
Remodel & Proload 16K,32K,48K	34.95
Renumber	7.95
Renumx	24.95
Roots	disk 19.95
RPN Calculator	9.95
RSM-2	26.95
RSM-2D	29.95
RX (disk)	24.95
Sargon Chess	19.95
Sargon II	29.95
Sargon Handbook	15.95 + $1
Secrets of the Tarot	9.95
Small Business Bookkeeping	tape 24.95
Small Business Bookkeeping	disk 29.95
Small Business Bookkeeping	journal 7.00
Snake Eggs (sound)	14.95
Space Battles	tape 14.95
Space Battles	disk 19.95
STAD	24.95
Star Trek III.4	14.95
ST80 Smart Terminal	49.95
ST80D Smarter Disk	79.95
ST80 III	150.00
ST80UC	24.95
Super Simon	$9.95
System Copy	9.95
T Short	9.95
Taipan	9.95
Tape Recorder Alignment Kit	9.95
Text 80 Disk	59.95
Time Series Analysis	14.95
Time Trek	14.95
Ting Tong Level II 16K	9.95
Tiny Comp	tape 19.95
Tiny Comp	disk 24.95
Troll's Gold	4.95
TRS-80 Assy. Lan. Pro.	3.95 + $1
TRS-80 Disk & Other Mysteries	22.95 + $1
TRS-80 Interfacing	8.95 + $1
TRS-80 Opera Theatre (sound)	9.95
with challenge on disk	19.95
Tycoon	7.95
Typing Tutor	19.95
VTOS 3.1	49.95
VTOS 3.1	manual 29.95 + $3
VTOS 3.1	w/manual 74.95 + $3
VTOS 3.1	w/BASIC 99.95 + $3
Warfare	7.95
Wordo	14.95
X-Wing Fighter II	9.95
XREF	19.95
Y-Y Bar by Racet	14.95
Z-80 Chip Poster	3.99 + $1
Z-80 Gourmet Cookbook	14.95 + $1
Z-80 Handbook	4.95 + $1
Z-80 and 8080 Assembly	7.95 + $1

APPLE*

Adventure Sampler	cass. 5.95
Alien Invasion	cass. 9.95
Android Nim	disk 17.95
Appen I Text Editor	cass. 17.95
Appilot Edu-Disk	disk 49.95
Apple 21	cass. 9.95
Apple Invader	cass. 15.95
	disk 19.95
Applelistner	cass. 15.95
Appletalker	cass. 15.95
Baseball	cass. 14.95
BASIC Handbook	14.95 + $1
Blitzkrieg	cass. 15.95
Breakthru	cass. 9.95
Bridge Challenger	cass. 14.95
CCA Data Base Manager	disk 99.50
(Works in conjunction with Visicalc)	
Count Adventure	cass. 14.95
Dan's Disk Utilities	disk 39.95
Dr. Memory	disk 49.95
Dungeon Campaign	cass. 12.50
	disk 14.95
Electric Crayon	cass. 17.95
Engineering Math Tape 1	cass. 14.95
Escape	cass. 12.95
Fastgammon	cass. 19.95
Form Letter	disk 24.95
Forte	cass. 19.95
Fun House Adventure	cass. 14.95
Game Playing Tape 1	cass. 9.95
Game Playing Tape 2	cass. 9.95
Game Playing Tape 3	cass. 9.95
General Math Tape 1	cass. 14.95
Global War	disk 24.95
Hi-Res Boxing	cass. 15.95
Higher Graphics	disk 24.95
Land Adventure	cass. 14.95
Little Book of BASIC Style	5.95 + $1
Mailing List	disk 39.95
Mailing List Database	disk 34.58
Master Catalog	disk 29.95
Maze Game	cass. 12.95
Memo Calendar	disk 29.95
Micro Information System	disk 99.95
Mission Impossible Adventure	cass. 14.95
Music Box	cass. 12.95
Pirates Cove Adventure	cass. 14.95
Pyramid of Doom Adventure	cass. 14.95
Sargon	cass. 19.95
Sargon II	cass. 29.95
Side Shows	cass. 12.95
Strange Odyssey Adventure	cass. 14.95
Stunt Cycle	cass. 15.95
Super-Text	disk 99.95
Tank War	cass. 12.95
Text Editor	disk 64.95
Three Mile Island	disk 39.95
U-Draw I	cass. 17.95
U-Draw II	disk 39.95
Uncle Sam's Jigsaw	cass. 12.95
Visicalc	disk 150.00
Voodoo Castle Adventure	cass. 14.95
Wilderness Campaign	cass. 14.95
	disk 17.50
Wilderness & Dungeon Campaigns	disk 29.95



ATARI®



A Warner Communications Company

ROM CARTRIDGES	
Assembler/Editor	59.95
Basketball	39.95
Video Easel	39.95
Super Breakout	39.95
Music Composer	59.95
Computer Chess	39.95
3D Tic-Tac-Toe	39.95
Star Raiders	59.95
Personal Finance	59.95
EDUCATION SYSTEM CASSETTE PROGRAMS	
U.S. History	29.95
U.S. Government	29.95
Supervisory Skills	29.95
World History (Western)	29.95
Basic Sociology	29.95
Counseling Procedures	29.95
Principles of Accounting	29.95
Physics	29.95
Great Classics	29.95
Business Communications	29.95
Basic Psychology	29.95
Effective Writing	29.95
Principles of Economics	29.95
Spelling	29.95
Basic Electricity	29.95
Basic Algebra	29.95
BASIC PROGRAM CASSETTES	
Introduction to Programming	19.95
Kingdom	14.95
Lemonade	14.95
Baseball	14.95
Blackjack	14.95
Mugwump	14.95
Biorhythm	14.95
Hangman	14.95

The Software Exchange

6 South Street, Box 68, Milford, NH 03055 603-673-5144

TO ORDER CALL TOLL-FREE

1-800-258-1790 (In NH call 673-5144)

*TRS-80 is a trademark of Tandy Corporation
*Apple is a registered trademark of Apple Computer Co.
*Atari is a registered trademark of Warner Communications.

Circle 151 on inquiry card.

May 12-13
Data Communications, Worcester Polytechnic Institute, Worcester MA. This seminar is designed to help professionals develop an effective data communications system. Network design, requirements, software, diagnostics, and controls are some of the issues to be covered. The fee is $375 which covers everything except hotels. For information, contact Office of Continuing Education, Worcester Polytechnic Institute, Worcester MA 01609.

May 13-15
Microprocessors: New Directions for Mankind, Albuquerque NM. This symposium will deal with a variety of microprocessor applications. It is part of the Ideas in Science and Electronics Show. Contact J Arlin Cooper, Div 2331, Sandia Laboratories, Albuquerque NM 87185.

May 13-15
Electro/80 Show and Convention, Hynes Auditorium and Boston Sheraton, Boston MA. This show consists of presentations and exhibitions by computer industry manufacturers. Contact Electronic Conventions Inc, 99 N Sepulveda Blvd, El Segundo CA 90245.

May 13-16
The Ninth Annual Conference of MUMPS Users Group, Islandia Hyatt House, San Diego CA. This meeting will bring together scientific, medical, and business professionals to discuss current research and application development. Areas of participation are paper presentations, workshops and tutorials, and vendor exhibits. Contact Dr Jack Bowie, MUG 80 Program Chairman, The Mitre Corp, Mail Stop 641, 1820 Dolley Madison Blvd, McLean VA 22102.

May 21-22
The Second Clemson Small Computer Conference, Clemson University, Clemson SC. This program will consist of presentations, discussions and an exhibition. Emphasis will be placed on business, industry, engineering, science, and education. For registration information, contact J K Johnson, Continuing Engineering Education, Clemson University, Clemson SC 29631. For general information, contact W J Barnett, Electrical and Computer Engineering Dept, Clemson University, Clemson SC 29631.

May 21-23
Business and Personal Computer Sales-Expo 80, Philadelphia Civic Center, Philadelphia PA. This show is aimed at a wide range of interests in business and any other area that has a need for computers and computer-related products. Exhibitors will be giving demonstrations of equipment. Contact Produx 2000 Inc, Roosevelt Blvd and Mascher St, Philadelphia PA 19120.

May 23
The Digital Computer Association, Annual Meeting, Pacifica Hotel, 6161 Centinela Blvd, Culver City CA. A slide show, followed by dinner and an evening program, are the main events of the meeting. The price is $15 prepaid. Send reservations to Mary Rich, 731 Bayonne St, El Segundo CA 90245.

May 24-25
Amateur Radio and Computer Hobbyists Second Annual Convention, Cervantes Convention Center, St Louis MO. Speakers, presentations, equipment displays, and a flea market will be featured. For more information, contact the Gateway Amateur Radio Assocation Inc, POB 68, Marissa IL 62257.

May 31

Amateur Radio Fair, Minnesota State Fairgrounds, St Paul MN. The North Area Repeater Association is sponsoring this swapfest and exposition for personal computer enthusiasts and radio amateurs. There will be free overnight parking for self-contained campers on May 30. The admission is $3. For information, write Amateur Fair, POB 30054, St Paul MN 55175.

May 31-June 1

Microcomputers and the Physician's Office, Hyatt Regency Hotel, San Francisco CA. This seminar will provide a realistic look at microcomputer applications in the private practice. Contact Medical Data Systems, POB 193, Ojai CA 93023.

JUNE 1980

June 2-4

Improving Productivity and Distributed Data Entry, Sheraton Center, New York NY. The conference and seminar schedule includes discussions on word processing, data processing, future directions of data entry, improving data entry productivity, automated offices, installing a data-entry incentive system, and more. Contact Data Entry Management Association, POB 3231, Stamford CT 06905.

June 4-5

Microprocessors: Hardware, Software, and Application, Holiday Inn, Boston MA. This course is recommended for technical professionals who need an understanding of microprocessors in relation to their corporate and business careers. Contact Office of Continuing Education, Worcester Polytechnic Institute, Worcester MA 01609.

June 4-6

Salon de l'Ordinateur Computer Show, Place Bonaventure, Montreal, CANADA. This exhibition will feature over eighty manufacturers' hardware and software.

For more information, contact Industrial Trade Shows of Canada, 36 Butterick St, Toronto, Ontario M8W 3Z8 CANADA.

June 9-13

Microcomputer Workshop, Carnegie-Mellon University, Pittsburgh PA. Engineers, research scientists, educators, and managers will benefit from this course. It covers all aspects of microcomputers and software. Hands-on-training will be provided. The tuition is $585 and housing can be arranged. Contact the Post College Professional Education, Carnegie-Mellon University, Pittsburgh PA 15213.

June 14

Microcomputers in Business and The Professions: Systems Selection, Butler University, 4600 N Sunset Ave, Indianapolis IN. This seminar will cover various types of hardware and software, how to evaluate the kinds and performances of computers, and their applications in business and home use. The registration fee is $75. For information, contact College of Business Administration, Butler University, 4600 N Sunset Ave, Indianapolis IN 46208.

June 15-18

International Summer Consumer Electronics Show, McCormick Place, McCormick Inn, Pick-Congress Hotel, Chicago IL. The Consumer Electronics Show (CES) will feature exhibits from many companies; seminars and discussions; and items ranging from televisions, tape recorders, telephones, and translators, to computers, component systems, auto sound systems, and electronic games will be displayed. Attendance is limited to dealers and the press. Contact Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 N Michigan Ave, Chicago Il 60601.

June 16-20
Data Flow Concepts in Computer Language and Architecture, Massachusetts Institute of Technology (MIT), Cambridge MA. MIT's program will cover principles of data flow computer organization and programming language design and applications. Certain architectures will be covered and techniques will be discussed. Familiarity with languages and architecture is a prerequisite. The tuition is $750. Living arrangements can be made through the school. Contact the Office of the Summer Session, Room E19-356, MIT, Cambridge MA 02139.

June 17-19
Data Comm, Palais des Expositions, Geneva, SWITZERLAND. Data communications and distributed-data processing are the main themes of this conference and exhibition. Software development and tools, computer languages, managing data-communications systems, and definitions, concepts, and applications of data communications and distributed-data processing are some of the topics that will be covered in the conference.

For more information, contact Industrial and Scientific Conference Management Inc, 222 W Adams St, Suite 999, Chicago IL 60606.

June 18-21
Association for Computational Linguistics, University of Pennsylvania, Philadelphia PA. The meeting will cover theoretical and methodological problems of computational linguistics, speech acts, analysis of multisentence texts, dialogue, machine translation, and computational semantics. For further information contact Don Walker, Artificial Intelligence Center, SRI International, 333 Ravenswood Ave, Menlo Park CA 94025.

June 20-22
The Fifth Annual Computerfest, Franklin University, Columbus OH. Sponsored by the Midwest Affiliation of Computer Clubs, this is a gathering of interested hobbyists, professionals, and business-oriented computer users. Workshops and discussions are the main features of the conference. Contact James Crowley, 4008 Rickenbacker Ave, Columbus OH 43213.

JULY 1980

July 7-11
Computers and Related Products, Hyatt Regency Hotel, Seoul, KOREA. This show is limited to approximately forty firms for exhibition. For details, contact Robert Wallace, Rm 6015A, US Dept of Commerce, Industry and Trade Commission, Washington DC 20230.

July 14-16
Diagnostic Software: Planning and Design, Sheraton-Lexington Motor Inn, Lexington MA. The seminar is for design, test, and diagnostic engineers. Design examples, lectures, informal sessions, and programming are part of the course. The fee is $450. Contact Professor Donald French, Institute for Advanced Professional Studies, One Gateway Center, Newton MA 02158.

July 14-18
SIGGRAPH '80, Seattle Center, Seattle WA. Panel discussions and readings will be included in this conference. The topics will include graphic displays, animation/dynamics, cartography, input techniques, video and color hardware, and more. For general information, write to SIGGRAPH '80, POB 88203, Seattle WA 98188.

July 22-24
Microcomputer Show, Wembley Center, London, ENGLAND. New products will be exhibited, along with presentations of papers. For information contact TMAC, 680 Beach St, Suite 428, San Francisco CA 94109. ■

Circle 160 on inquiry card.

DISCOUNT SOFTWARE

CP/M®

OSBORNE AND ASSOC.
business software in CBASIC-2 — DISK WITH MANUAL / MANUAL ONLY

# General Ledger / # Acct. Rec./Acct. Pay. / # Payroll w/Cost Acct.	$59/$19 each
Buy 2 get 1 free	$118/$57
All 3 plus CBASIC-2	$199/$71

CBASIC-2® .... $89/$14

DIGITAL RESEARCH
CP/M® 2.2 for TRS-80® Model II $149/$24
CP/M® 2.2 for Northstar..... $149/$24

WORDSTAR by MicroPro......... $399/$24

WHITESMITHS
*"C" Complier............ $600/$29
*Pascal (includes "C")...... $750/$44

SELECTOR III-C2............. $269/$19

PEACHTREE business software
in Microsoft BASIC source code.

† General Ledger / † Acct. Rec. / † Acct. Pay. / † Payroll / † Inventory	$399/$65 each
All 5 plus WORDSTAR	$1995/$349

TRS-80® MODEL II

CP/M® 2.2
Latest Version................ $149

ELECTRIC PENCIL II
Standard Printer.............. $249
Diablo, Qume, NEC............ $279

APPLE II®

VISICALC® by Personal Systems... $122

VISA • MASTERCHARGE
ORDERS ONLY — CALL TOLL FREE
1-800-854-2003 ext. **823 A**
Calif. 1-800-522-1500 ext. **823 A**

For information write or call:
THE DISCOUNT SOFTWARE GROUP
1610 Argyle Ave., Bldg. 102
Los Angeles, CA 90028
(213) 461-3127

CP/M users: specify disk systems and formats. Most formats available.

Add $2.50 postage and handling per each item. California residents add 6% sales tax. Allow 2 weeks on checks. C.O.D. ok.

Prices subject to change without notice. All items subject to availability.

* — Special Bonus with order # — Requires CBASIC-2
† — Requires microsoft BASIC ® — Mfgs. Trademark

P.S. — We want to be your software source. Give us the opportunity to beat any nationally advertised price!

ED SMITH'S SOFTWARE WORKS
6809 SOFTWARE TOOLS

RRMAC M6809 RELOCATABLE RECURSIVE MACROASSEMBLER. The one assembler that contains *real* macro capabilities (see our May, June BYTE ad). RRMAC is designed with the assembly language programmer in mind and contains many programmer convenience features. RRMAC contains a mini-editor, supports spooling or co-resident assembly, allows insert files, is romable, generates cross-references, execution times, lists target addresses of all relative references.
M69RR **$150.00**

SGEN M6809 DISASSEMBLER/SOURCE GENERATOR will produce source code (with symbolic labels) suitable for immediate re-assembly or re-editing. The output source file can be put on tape or disk. A full assembly type output listing with labels and mnemonic instructions can be printed or displayed on your terminal. Large object programs can be segmented into small source files. **M69RS** .... **$ 50.00**

ANNOUNCING TWO NEW M6809 DEVELOPMENT TOOLS

CROSSBAK—A 6809 TO 6800 CROSS MACROASSEMBLER that runs on your M6809 development system to produce relocatable M6800 object code. Has all features of M69RR (see above). Includes 6800 Linking Loader. **M69CX** **$200.00**

CROSSGEN—A 6800 OBJECT CODE DISASSEMBLER/SOURCE GENERATOR that runs on your M6809 development system. Has all features of M69RS (see above). An invaluable tool for converting all 6800 object files over to the M6809. **M69CS** .... **$ 75.00**

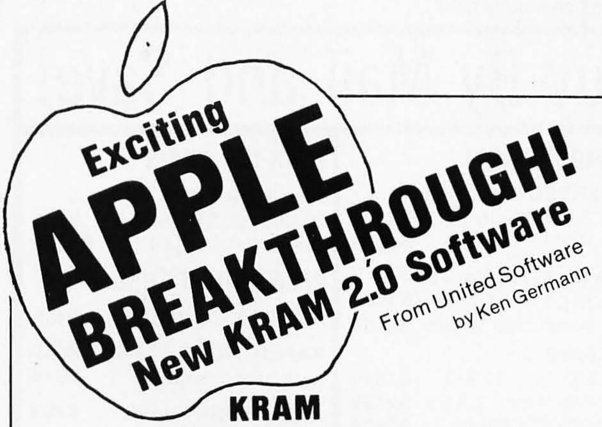
All programs are relocatable and come complete with Linking Loader, Programmer's Guide and extensively commented assembly listing. Available on 300 Baud cassette or mini-floppy disk. For disk, specify SSB or FLEX. Source Text input/output is TSC/SSB editor/assembler compatable.

Order directly by check or MC/Visa. California residents add 6% sales tax. Customers outside of U.S. or Canada add $5 for air postage & handling.

Dealer inquiries welcome. FLEX is a trademark of TSC

Ed Smith's **SOFTWARE WORKS**
P.O. Box 339, Redondo Beach, CA 90277, (213) 373-3350

Circle 161 on inquiry card.



KRAM
Keyed Random Access Method

KRAM is the **FASTEST** and **MOST POWERFUL** keyed access method available for the Appple Computer. Written entirely in 6502 machine code, **KRAM** is extremely fast, comprehensive in scope, very compact, and easy to use. **KRAM** function calls are invoked via a single instruction.

Using the sophisticated capabilities of **KRAM** the Apple Computer can now fully meet the requirements of information management applications, such as: Accounts Receivable/Payable, Inventory Control, General Ledger, Payroll, and Database Management.

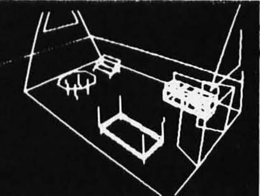
KRAM Release 2.0 Functions:
- Create/Open a dataset • Put record by Key
- Add & delete records by key
- Get any record by Full/Partial key in 4/10ths of a second (2/10ths with Corvus Disk)
- Read next or previous record
- Dynamic space allocation
- Dynamic space reclamation
- Dynamic index compression

Introductory Special $99.95

An 80 page manual fully documents **KRAM** 2.0 detailing **KRAM** functions and illustrating with programming samples. **KRAM** architecture is fully explained and a sample mailing list application program is included.

KRAM is designed to work with both Apple's Disk II, or Corvus Systems 10 Megabyte Winchester Disk. **KRAM 2.0** requires an integer Apple or Apple Plus with integer card and at least one disk drive. Will not work with language system.

PET/CBM OWNERS — KRAM 2.0 for 40/80 column 16K/32K PETS and 2040/3040/8050 disk units is available for $99.95



3-D Animated Graphics
APPLE WORLD
By Paul Lutus

The Program made famous on National TV!

APPLE WORLD turns your Apple into a sophisticated graphics system capable of creating animated three-dimensional color images, projecting them in true perspective on the screen, rotate them, move them closer, further away, and many other things.

A powerful screen-oriented text editor is included to facilitate image formation. This program was recently featuredon Tom Snyder's *Prime Time Saturday* TV Show and is now available for sale.

APPLE WORLD'S powerful editor is so easy to use that children will love it. You can now "sketch" your dream house, boat, car, or fantasy empire. Then view it as it would be seen from 10,000 feet, or you can ZOOM in until the screen is filled with a doorknob. You could then go inside and move from room to room examining furniture placement as your screen rotates within the room. Images or specific parts of images can easily be saved to disk or printer.

Does all this sound like science fiction? You won't think so after you have visited **Apple World.** ***Introductory Price $59.95***
36 page manual included

Look for USA's Red-White-Blue Software Rack at your local computer store or send in your order plus $1.00 shipping to:

USA United Software of America
750 3rd Ave., New York, NY 10017
(212) 682-0347 **Dealer Inquires Invited**

Circle 168 on inquiry card.

P&T CP/M® 2 unleashes the POWER of your TRS-80 MODEL II

Pickles & Trout has adapted CP/M 2, one of the world's most popular operating systems, to the TRS-80 Model II and the result is spectacular:

- 596K bytes usable storage at double density
- Runs both single and double density disks with automatic density select
- Single drive backup
- Multi-drive software can run on a 1 drive system
- Operates with 1, 2, 3, or 4 drives
- Full function CRT control
- Type-ahead buffer for keyboard input
- Full access to both serial ports and parallel printer port
- Fully software programmable serial ports
- Loads an 18K Basic in 2.5 seconds
- Full compatibility with existing CP/M software and application packages
- Full set of 7 CP/M manuals plus our own for the TRS-80 Model II

Introductory price: $175

Prepaid, COD, Mastercharge or Visa orders accepted
Shipping extra. California residents add 6% sales tax.



PICKLES & TROUT
P.O. BOX 1206, GOLETA, CA 93017, (805) 967-9563

CP/M is a trademark of Digital Research Inc. TRS-80 is a trademark of Tandy Corp.

8088 S100 CPU

Want to upgrade your 8 bit system to a 16 bit system? Don't want to discard your 8 bit boards? The **LDP88** offers 10 to 20 times the processing power of your present CPU while retaining compatibility with your 8 bit memory and peripherals. The **LDP88** is a single board computer with complete **IEEE S100** bus compatibility. The board has the following features:

- Up to 8K bytes of ROM/EPROM
- 1K bytes static RAM
- 8 vectored interrupts
- Serial I/O port
- 16 bit instruction set
- **8086** software compatibility
- Address up to 1 Megabyte of memory

PRICE: $399.99 (assembled and tested)

Serial monitor for CRT or TTY: $79.99
(Mass. residents add 5% sales tax)

See your March and April BYTE for Steve Ciarcia's articles about the 8088.

To order send check or money order to:

Lomas Data Products
11 Cross Street
Westborough, MA 01581
Telephone: (617) 366-4335

Circle 169 on inquiry card.

Circle 167 on inquiry card.

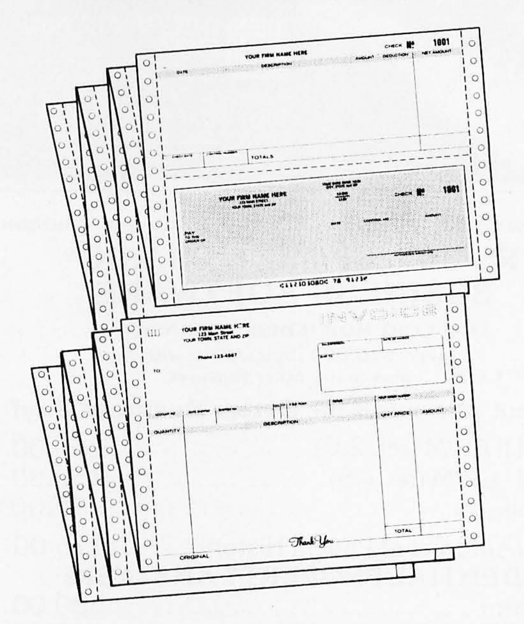


FREE COMPUTER FORMS KIT

EACH KIT CONTAINS:

Samples, Prices, Order Form, 4 Checks, 2 Statements, 2 Invoices, Programming Guides.

We specialize in small quantities, low prices.
500 CHECKS ONLY $29.95



SEND COUPON, CIRCLE BINGO or PHONE TOLL FREE 1+800-225-9540

FAST SERVICE – It is our policy to ship within 6 working days following our receipt of your order. CODE 459

Name ____________________

Address ____________________

City ____________________

State, Zip ____________________

NEW ENGLAND BUSINESS SERVICE, INC.
GROTON, MASS. 01450

The 'Red Box'. Our dynamite duo!

Bit Error Rate Test Set – EIA Interface Breakout Panel in pocket size package.

IDS'S MODEL 65/60 lets you both analyze and test at the EIA interface between a modem and terminal. Combines our popular "Blue Box" model 60 with a new bit error rate test set. All in one light, portable, hard plastic case. Works on rechargeable batteries. Available now.

INTERNATIONAL DATA SCIENCES, INC.
7 Wellington Rd., Lincoln, R.I. 02865
Tel. 401-333-6200 TWX 710-384-1911
Export: EMEC, Box 1285,
Hallandale, Fla. 33009 Telex 51-43-32



TRS-80® CP/M® & CBASIC® BUSINESS SOFTWARE

LOW-COST MOD II DISK EXPANSION
. . . over 610,000 bytes/disk with our CP/M . . . plus many other features.

Find out why ours is the **Better Business Buy!**

Model II CP/M (rel. 2.0) $250.00
Model I CP/M (re. 1.5) 150.00
CBASIC 95.00

APH (Automated Patient History) 175.00
RESIDENTIAL PROPERTY ANALYSIS system 300.00
MAGIC WAND® Word Processor 400.00
RM COBOL® (Z80 code) 750.00

Osborne & Assoc. CBASIC source programs—
O&A **Payroll** w/Cost Accounting. $250.00
O&A **Accts. Rec./Accts. Payable** . . . 250.00
O&A **General Ledger** w/Cash Journal. 250.00
O&A CBASIC books for above (each) 20.00

Send 30¢ SASE for CP/M Users Group software list & free "CP/M Primer".

® MAGIC WAND is a registered trademark of Small Business Applications, Inc
® RM COBOL is a registered trademark of Ryan-McFarland Corp
® TRS 80 is a registered trademark of Radio Shack, a Tandy company
* CP/M is a registered trademark of Digital Research
* CBASIC is a registered trademark of Software Systems



(714) 848-1922

8041 NEWMAN AVENUE • SUITE 208 • HUNTINGTON BEACH, CALIFORNIA 92647

For Business Systems Software Programmers Only!! Machine Language ISAM

FOR
TRS-80* Models I and II
ACCESS TIME ½ SECOND!!

This machine language **ISAM ROUTINE** provides file access sophistication required to implement complex business software, and is completely **compatible with TRS-80* BASIC.**

Specifications: based on 1000 record file, key length of 6, data length of 64

Access time of ½ second
Best add/delete time of 1 second
Average add/delete time of 2 seconds
Worst case add/delete time of 5 seconds
Keys up to 25 characters
Data up to 255
Provides next highest key upon each file access.
Preset range of allowable key values, set upon file creation up to 4 files held open concurrently.
No special utilities needed to "Reclaim" used record space.
Model I Routine occupies 5 K of user space (loads at top of user memory)
Model II Routine occupies 6 K of user space (loads at top of user memory)
EOF, file full, empty, key not found, INVALID key value and all **TRS DOS*** error codes supported.

TRS-80 Model I (32 K + 48 K only) $160.00
TRS-80 Model II (64 K only) $170.00

Includes: All necessary documentation, file creation program, file inspection program, machine language ISAM routine and loader.



RELIABLE COMPUTER RESOURCES
415 MILLBURY STREET
WORCESTER, MA 01607
(617) 755-8134

**TRS-80 and TRS DOS are trademark of Tandy Corporation, which has no relationship to RCR Inc.*

Circle 173 on inquiry card.

Circle 174 on inquiry card.

MICAH

OSBORNE BUSINESS SOFTWARE

in CBASIC2 *or* CROMEMCO 16K BASIC

★ *features* ★

- Four Complete Packages---
  - General Ledger
  - Accounts Receivable
  - Accounts Payable
  - Payroll with Cost Accounting
- Strong support from Osborne Manuals
- CBASIC2 runs under CP/M or under CDOS version 1.07 on Cromemco computers
- 16K BASIC runs on Cromemco computers
- Cursor addressing routines for Hazeltine, Lear Siegler and Cromemco (Beehive) Terminals
- Source Codes and Installation Instructions provided along with disks
- Automatic Command Start-up
- Easy to apply to all of your business and systems needs

★ *hardware required* ★

- One or more 8" or 5" Floppy Drives
- CRT with cursor addressing
- 132-Column Printer

$95 *per package*

TO ORDER
Add $5 for shipping
Calif add 6-1/2% Sales Tax
CREDIT CARDS ACCEPTED

• **DEALER INQUIRIES INVITED** •

MICAH'S PRODUCTS OF DISTINCTION

- OSBORNE BUSINESS SOFTWARE (in CBASIC2 & 16K)
- CBIOS (CP/M for Cromemco Computers)
- MICROPLOT (Versatile Printer Graphics)
- DŪP/1 (Disk Utilities for CP/M and CDOS)
- DŪP/2 (Disk Utilities for Cromemco)
- DŪP/3 (DŪP/2 Expanded)
- SPOOL (Cromemco Format Utility)
- EXPAND (Run Cromemco Software on CP/M)
- BLACKJACK (Tutorial Casino Action)
- DRIVE (Customized Printer Drivers)
- DBMS Conversion to NAD

• Call or Write for Free Catalogue and More Information •

★ **We will Customize any of our programs at our Standard Consulting Rates** ★

Ah! MICAH . . . .Satisfyin' Software

That turns your system on!

MICro Applications and Hardware

• **CONSULTANTS and SOFTWARE DEVELOPERS** •

MICAH Box 22212 San Francisco, California 94122 USA phone: 415/664-0778

FROM THE ORIGINATOR OF THE TRS-80 PROJECT...

FMG Corporation—for HIGH LEVEL LANGUAGES

- FORTRAN
- PASCAL
- COBOL
- BASIC

Microcomputer software for business applications, engineers, consumers, hobbyists and others who have a serious interest in computers.

SEND FOR FREE SOFTWARE CATALOG

- **CP/M — Industry Standard Operating System**
- **USCD PASCAL PACKAGE**
- **GENERAL LEDGER; PAYROLL; ACCOUNTS RECEIVABLE and ACCOUNTS PAYABLE**
- **FORTRAN-80 PACKAGE — New Capabilities for TRS-80 Users**
- **FMG's MICRO COBOL — For TRS-80 and TRS-80 Model II**
- **CP/M Z80 — Macro Assembler**
- **ZSID — Symbolic Debugger**
- **Custom Programming, Service, Installation and Training are Available at Additional Cost**





M- 450

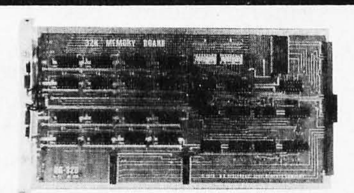
FMG Corporation is an Independent Software Company — from the ORIGINATOR OF THE TRS-80 PROJECT and THE AUTHOR OF THE FIRST CP/M FOR THE TRS-80.



5280 Trail Lake Drive
Suite 14
Ft. Worth, Texas 76133
(817) 294-2510

CP/M is a registered trademark of Digital Research Corp.
TRS-80 is a registered trademark of Radio Shack.

HEATH® COMPATIBLE



DG-32D 32K RAM FEATURES:

- Plugs into Heath® H8 Computer.
- Ready to use. Fully assembled, tested & burned in.
- Operates with existing Heath® memory.
- Protected memory Output Buffers in the event of Address error.
- Utilizes popular 4116 RAM devices.
- Memory Address DIP switch changeable.
- Arranged as 4 Independent 8K Blocks.
- Low Power Consumption: Less than 6 watts, typical.
- Transparent Refresh.
- One year guarantee.
- Compatible with all current H8 peripherals.

D•G Electronic Developments Co. brings you a totally compatible, fully assembled and tested 32K RAM for Heath® H8 computers. The DG-32D has less than 6 watts power consumption. This allows you to add a full 32K bytes of Random Access Memory without taxing or replacing your computer's power supply. Engineered to plug-in and run without any user modifications, the DG-32D can be used with or without existing H8 RAM without modification. Protection of the memory output buffers is provided in the event of assigning two blocks to the same address space. The DG-32D is the ideal answer to expansion of the Heath® H8 computer. . . Low power consumption, low price, high capacity, total engineering and exacting production methods.

Heath® and H8 are registered trademarks of the Heath Corporation, Benton Harbor, Michigan.

BURNED IN 16K MEMORY CHIP SET
H88-H89 .... **$89.00**

ORDERING INFORMATION: DG-32D RAM available only from DG Electronic Developments Co., P.O. Box 1124, 1827 South Armstrong, Denison, Texas 75020. Check, money-order, VISA or Master Charge. Phone orders accepted on charge orders. NO COD's. Foreign orders add 30%. Texas residents add 5%. For VISA or Master Charge orders call 214-465-7805. $479.00 freight prepaid. Allow three weeks for personal checks to clear banks.



32K RAM $479.00

Circle 175 on inquiry card.

Error Checking and Correcting for Your Computer

Gregory J Walker, President
Design Innovations, Inc
Birch Acres
New London NH 03257

An active error-checking and correcting system can go a long way toward solving the occasional problems that hamper the usefulness of low-cost data-storage devices (such as audio-cassette recorders). It offers a means of improving reliability in problem-plagued situations, and in cases where the error frequency is already sufficiently low, the checking and correcting system allows increased data densities and transfer rates with an overall gain in storage system performance. In a well-designed system, error detection and correction schemes can lead to marked reductions in loading times due to higher average data rates.

Figure 1 shows the connection of the active error-checking and correcting apparatus between the computer and the peripheral data-storage device.

The theoretical development of error-trapping and correcting codes is largely due to the efforts of Richard W Hamming, a mathematician who first published on the subject in the *Bell System Technical Journal* early in 1950. (See reference 1.) Now, thirty years later, *Hamming codes* still represent one of the more practical approaches to the error-correcting problem.

A particularly important aspect of Hamming's work focused on his formulation of the concept of *code distance* (indicated by the letter D). This relates the uniqueness of (or "distance between") meaningful codes to the number of *simultaneous* errors (indicated by the Greek theta, θ) that can be detected and corrected.

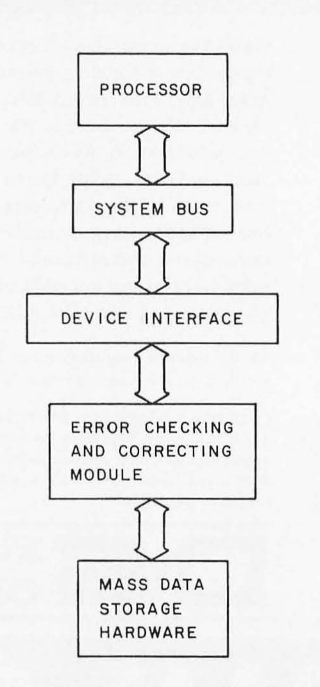


Figure 1: *Block diagram showing interconnection of error-checking and correcting system with the computer.*

Definition of Hamming Distance

The Hamming distance between any two words is defined as the number of bit positions in which they differ. In terms of logical processes this is merely the total number of bits set to logic 1 following an exclusive-OR operation between the two words, as shown in figure 2. Simple binary coding has a Hamming distance of 1. This unitary distance is precisely the source of the problem, because any given code value appears to be as valid as any other.

Normally, as a processor receives binary data from a peripheral device, no mechanism is present which can correct a bit inversion. If a bit is read erroneously, it will either invalidate the check sum and cause an error trap, or it will be loaded into main memory without detection, thus propagating the error. It may or may not be a critical fault.

Consider the following 4-bit code:

Symbol	Encoded Form bit 3210
0	0001
1	0010
2	0100
3	1000

This limited shifting pattern generates a code format with a Ham-



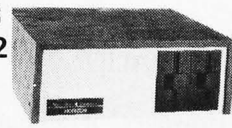
WE CARRY —

- CROMEMCO
- NORTH STAR
- VECTOR GRAPHICS
- THINKER TOYS
- NEC
- CENTRONICS
- INTERTUBE — $750.00
- SERENDIPITY
- SOROC — $775.00
- TEXAS INSTRUMENTS

Professional A/R, A/P, Ledger, Payroll, Medical Billing software with customization available. Send for our catalog — Send for quote.
Call for quote.



SARA-TECH COMPUTERS
P.O. Box 692
Venice, FL
33595
(813) 485-3559

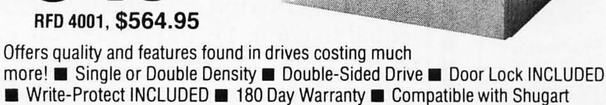


Why pay more . . . and get less?
Sirius gives you lower prices and higher quality!

Remex RFD 4000/4001 8" Floppy Disc Drives Double sided . . . Double density!!

$549.95

RFD 4001, $564.95



Offers quality and features found in drives costing much more! ■ Single or Double Density ■ Double-Sided Drive ■ Door Lock INCLUDED ■ Write-Protect INCLUDED ■ 180 Day Warranty ■ Compatible with Shugart 850/851 ■ Low Power Operation ensures LONGER LIFE!! ■ Model RFD 4001 offers Data and Sector Separator

AVAILABLE OPTIONS/ACCESSORIES
☐ Single Drive Power Module, $119.95 ☐ RFD4000 Manual, $5.95 ☐ Drive Cabinet, $29.95
☐ Dual Drive Power Module, $139.95 ☐ Interface Manual, $2.95

Remex 1000B . . . If you've been looking for a less expensive floppy disc drive, but not wanting to sacrifice quality — this is it!

$419.95

You get both in the Remex 1000B! For only $419.95 look at what you get: ■ 8" Floppy Drive ■ Single or Double Density ■ Hard or Soft Sectoring ■ Media Protection Feature ■ Single Density Data Separator ■ 180 Day Factory Warranty

AVAILABLE OPTIONS/ACCESSORIES
☐ Door Lock, $19.95 ☐ Connectors, $9.95 ☐ Interface Manual, $2.95
☐ Write-Protect, $19.95 ☐ Drive Cabinet, $29.95 ☐ 1000B Technical Manual, $5.95
☐ Interface Adapter (Remex to Shugart), $12.95

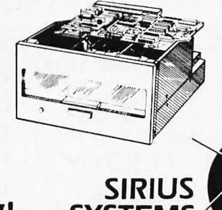
SIRIUS 80plus Series . . . perfect add-ons for your TRS-80*!

- *Comes complete ready to plug in and run!*
- *5ms track to track*
- *SIRIUS 80+1 and 80+2 — up to 102,000 bytes*
- *SIRIUS 80+3 and 80+4 — 240K and 480K bytes*

SIRIUS 80+1 (Single Head) **$349.95**
SIRIUS 80+2 (Dual Head) **$419.95**
SIRIUS 80+3 (Single Head) **$439.95** **SIRIUS 80+4** (Dual Head) **$539.95**

MPI 51/52 . . . A Great Reliable Mini-Drive!

- *Fast! 5ms track to track access*
- *Exclusive Pulley-Band Design*
- *Unique Door/Ejector Mechanism*
- *Reliable 1½% Speed Stability*



MPI-51 (Single Head) **$259.95**
MPI-52 (Dual Head) **$349.95**

MPI 91/92 . . . More Drive For Your Money! 240K/480K!

MPI-91 (Single/240K) **$349.95**
MPI-92 (Dual/480K) **$449.95**

*TRS-80© Tandy Corp.

SIRIUS SYSTEMS
(615) 577-1072
P.O Box 9748, Knoxville, TN 37920
Phone Orders accepted 9AM-7PM (EST)
VOLUME DISCOUNTS AVAILABLE

01001111 11101001	}	10100110
00000000 00000001	}	00000001
00000000 11111110	}	11111110
01010101 10101010	}	11111111

Figure 2: *The logical exclusive-OR function produces the output bytes shown in the right column from the input bytes shown in the left column. For each bit, the output bit is a 1 if and only if* one *of the input bits is a 1.*

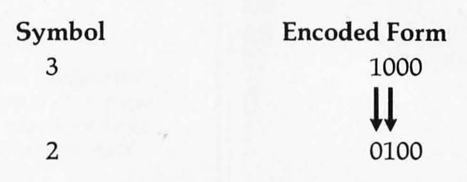
Hamming Distance (Minimum)	
1	code uniqueness
2	single-error detection
3	single-error correction
4	single-error correction/double-error detection
5	double-error correction

Table 1: *Minimum Hamming code distances necessary to obtain the listed properties in a particular coding scheme. Capabilities increase directly as Hamming distance increases (for small distances). Correction of an arbitrary number of errors requires a Hamming distance of at least twice the number of errors plus 1.*

ming distance of 2. It is impossible to invert a single bit position and create any one of the other three valid words.

Symbol	Encoded Form
3	1000
	↓
INVALID	1100

However, if a dual error occurred, the code's error-detection capability would fail:

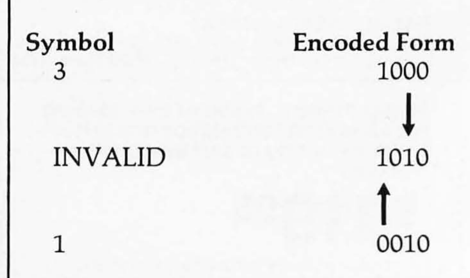


As indicated above, when the Hamming distance increases, the allowable number of simultaneous errors, θ, also rises. Errors can be trapped effectively as long as θ does not equal or exceed the Hamming distance minus 1 (D − 1). This should be clear, any sequence of (D − 1) errors will result in the generation of a meaningless code word if the distance between code words is given by D. No series of (D − 1) errors will produce a meaningful code.

Correcting Errors

Error-*correction* capability necessitates a larger Hamming distance, as shown in table 1. Any pattern of θ errors can be corrected if, and only if the Hamming distance D is greater than or equal to $(2\theta + 1)$. In this case, any received data word with θ errors differs from the transmitted, correct word in θ positions, but it also differs from all *other* meaningful words in at least $(2\theta + 1 - \theta)$, that is, $(\theta + 1)$ positions.

The erroneously received word therefore lies closer to the correct transmitted word than to any other possible word. Thus, it is possible to reconstruct the proper coding and recover the correct data word. To illustrate this point, the 4-bit code from the previous example does not meet the criterion of D greater than or equal to $(2\theta + 1)$, and is therefore uncorrectable. A single bit error in either of the two positions can lead to the same erroneous code:



Examination of the invalid code (1010) yields no information concerning what the correct pattern was initially. This meaningless value (1010)



Circle 180 on inquiry card.

SuperBrain® Software.

	MICROSOFT	C-BASIC	PRICE
A/R	X	X	$250.00
A/P	X	X	$250.00
G/L	X	X	$250.00
P/R	X	X	$250.00
Inventory	X	X	$250.00
Restaurant Payroll	X		$250.00
Mailing List	X		$150.00

Circle 181 on inquiry card.

Z_S-SYSTEMS
ZOBEX INC.

Complete computer on 3 S-100 boards for UNDER $1000.00*
Runs M/PM, C/PM and OMNIX

64K RAM
4 MHz
No WAIT States
IEEE Std.

Low power,
DMA operation,
Bank select in 16K sections
Can be disabled in 4K increments

Z80 CPU
2-4 MHZ

3 serial ports, 3 parallel, one 4K
EPROM, Vectored interrupts, real time

could have been generated from an originally encoded 3 (pattern 1000), with an error in bit 1, or from an encoded 1 (pattern 0010) with an error in bit 3. Without any additional information, it is impossible to distinguish between these cases. Once an error occurs, although it can be trapped by searching for invalid codes, it cannot be corrected.

Now consider the correctable code:

Symbol	Encoded Form
0	00000
1	11101
2	11010
3	00111

Examination of this new code reveals a minimum Hamming distance (D) of 3 between the various states, permitting single error correction. (See table 1.) The inefficiency of this code is obvious; however it should be clear that any single error can be detected and *located* using this scheme.

Symbol	Encoded Form
0	00000
	↓
INVALID	00001

The erroneous pattern could only be the result of encoding a 0 with an inversion in the least significant bit. Given the word 00001, the original, correct coding could be restored. This can be attributed to the fact that even the invalid, meaningless patterns display a limited uniqueness, and are directly traceable to specific *valid* codes subject to a small number of errors.

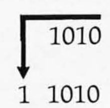
Symbol	Binary Form	7-bit Encoded Form
00	0000	1110000
01	0001	1000001
02	0010	0100010
03	0011	0010011
04	0100	0000100
05	0101	0110101
06	0110	1010110
07	0111	1100111
08	1000	0011000
09	1001	0101001
10	1010	1001010
11	1011	1111011
12	1100	1101100
13	1101	1011101
14	1110	0111110
15	1111	0001111

Table 2: *Sixteen different logical entities or symbols can normally be represented by a 4-bit code. Use of a unique 7-bit encoding increases the Hamming distance to 3 and allows a single-bit error correction.*

Uses of Parity

Clearly, coding efficiency is hampered as the Hamming distance is increased and as the requirements for trapping and correcting power are made more stringent. It becomes a matter of systematically generating a code that displays enough "correcting power" to handle data words of a useful length, without creating an excessive code-redundancy overhead. Here, the concept of *parity* plays an important role. Parity is established in a data word through the setting of an *additional* bit, such that the total number of bits set to logic 1 is either always odd or always even.

The operation of simple parity encoding and decoding is easy to understand. Assume, for example, that a data word 4 bits wide undergoes an odd-parity test across the entire word:



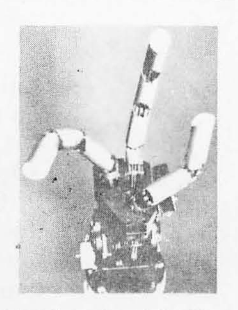
During encoding in this example, the fifth bit (the parity bit) is set to establish *odd* parity. Upon decoding, if the parity bit is included in an identical parity check, namely odd parity across the entire word (now 5 bits wide), the output of the parity test will be a logic 0.

If at some point between encoding and decoding, an error forces an inversion in a single bit (eg: with an error in bit 3, input to the decoder will be 10010), the odd-parity test will

Circle 182 on inquiry card.

Circle 183 on inquiry card.

GIVE YOUR COMPUTER *A* HAND



Have you ever wanted to do more with your micro than play computer games and balance your checkbook? **Robotics Age** gives you all the information you need to transform your home computer into a working *ROBOT!* Every aspect of robot research and experimentation—from the basic principles to the latest developments in laboratories around the world—is covered. Special emphasis is given to plans, circuits, and programs that you can use in your own microcomputer-controlled robot. Each article is designed to be understandable to the novice experimenter, but with technical detail and complete references that will satisfy even the professional researcher. Added to that are robotics-related New Products, Book Reviews, abstracts of selected recent technical papers, and reports on how you can participate in the growing number of robotics and Artificial Intelligence organizations in the US and abroad. Join the thousands of **Robotics Age** readers and learn how you can contribute to the development of the intelligent robots of the future—*Subscribe Today!*

ROBOTICS AGE P.O. Box 801, La Canada, CA 91011

☐ 1 yr. (4 issues)—US:$8.50; Canada & Mexico:$10; Foreign:$12
☐ 2 yrs. (8 issues)—US:$16; Canada & Mexico: $19; Foreign:$23
Payment enclosed ☐ Bill me (No. America only) ☐ Bill my Mastercharge ☐ VISA ☐

Number

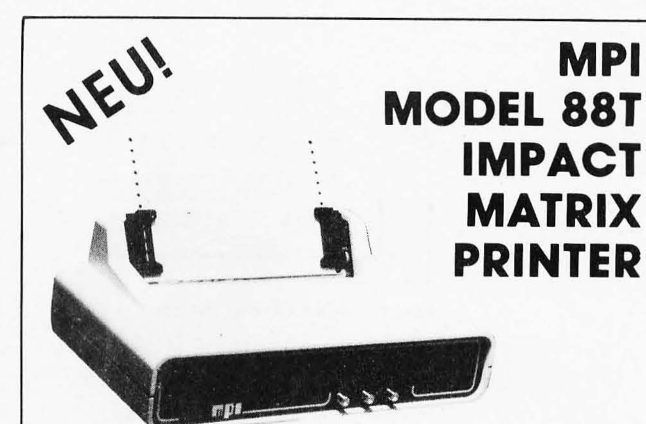
Signature (required) Expiration date

Name

Address

City State Zip

MPI MODEL 88T IMPACT MATRIX PRINTER



The first of a series of new, full-capability, low cost, high performance printers designed by MPI to meet the requirements of the general use computer market - hobbyist or professional.

SPECIFICATIONS

- Impact Bidirectional
- 7×7 Dot Matrix
- 100 Characters Per Second
- 80, 96 and 132 Column
- 10 Lines Per Second
- Tractor and Friction Feed
- Normal Paper: Roll, Fan-fold or Cut Sheets
- 115/230 VAC ±10%, 50/60 Hz.
- 96 ASCII Upper and Lower
- RS232C; 20 ma. Current Loop
- 110-1200 BAUD
- 2 Line Buffer; 1 or 2 K Optional
- Centronics Parallel
- 41×27×16 cm; 7 Kg.

Sigma International, Inc. is master international distributor for **MPI** and seeks dealers/distributors worldwide. Please write us on your letterhead at the following address:

SIGMA INTERNATIONAL, INC.
P.O.Box 1118 SCOTTSDALE, AZ 85252 USA
Tel. (602) 994-3435 Tlx. 165-745 Sigma Cable: SIGMAS

THE MM-103 DATA MODEM AND COMMUNICATIONS ADAPTER

S-100 bus compatible

FCC APPROVED

Both the modem and telephone system interface are FCC approved, accomplishing all the required protective functions with a miniaturized, proprietary protective coupler.

HIGH QUALITY

-50 dBm sensitivity. Auto answer. Auto originate. Auto dialer with computer-controlled dial rate. 61 to 300 baud (anywhere over the long-distance telephone network), rate selection under computer control. Flexible, software-controlled, maskable interrupt system.

WARRANTY

One year limited warranty. Ten-day unconditional return privilege. Minimal cost, 24-hour exchange policy for units not in warranty.

ASSEMBLED & TESTED

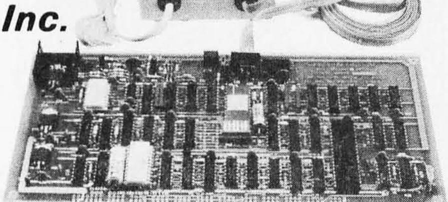
Not a kit! (FCC registration prohibits kits)

LOW PRICE—$359.95— For Modem AND Coupler plus shipping & handling





Potomac Micro-Magic, Inc.



Write for brochure:
First Lincolnia Bldg., Suite B1
4810 Beauregard St.
Alexandria, Va. 22312

Call for further information:
VOICE: (703) 750-3727
MODEM: (703) 750-0930 (300 baud)



Circle 184 on inquiry card.

fail and produce a logic 1 signifying an error.

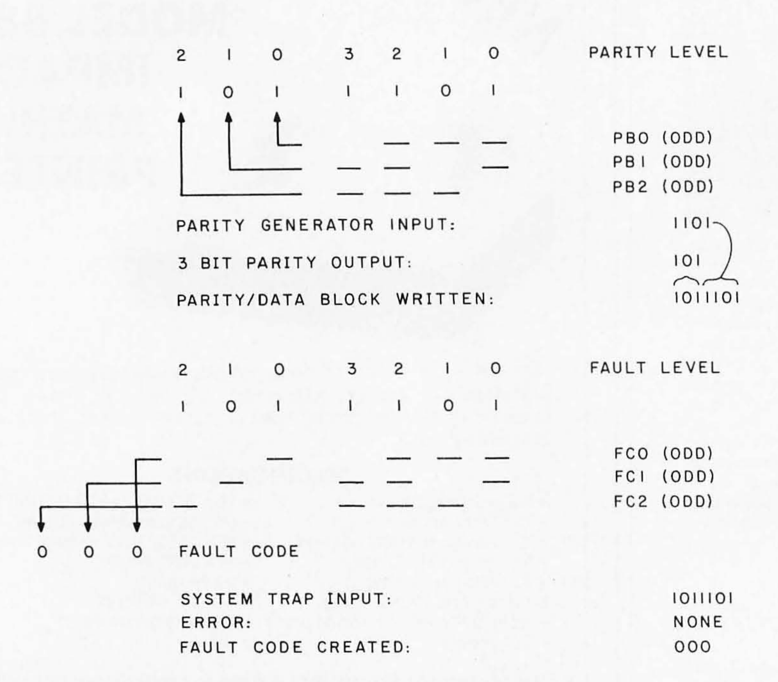


Figure 3: *Sixteen different logical states may be represented in a 7-bit code with a Hamming distance of 3. Single-bit errors may be detected and corrected. Encoding in 7 bits is accomplished by performing three distinct parity checks on 4 data bits. Table 4 shows the possible fault codes. The fault code of 000 indicates that no error was detected in decoding.*

Operation of Hamming Codes

Certainly this mechanism can be fooled by multiple errors, but it is possible to construct *multiple-level* parity checks which will trap a surprising number of errors. This is precisely how the Hamming codes operate. Fundamentally, Hamming's algorithm performs multiple-level parity generation on a data word at the data source. This parity code is then transmitted along with the data, and the entire code block (data plus parity code) is subsequently decoded under an analogous process. Any bit errors occurring during transmission will be detected.

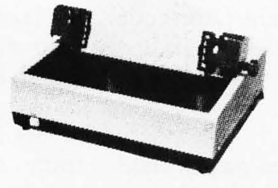
Clearly, the efficiency of this error trap will approach 100% only in very simple cases. Several parameters have direct bearing on the trapping success: total word length N, number of data bits K, number of parity bits M (M = N − K). The ultimate goal, of course, is to realize the ideal where the quantity N/K approaches 1, and M is minimized without sacrificing trapping and correcting capability.

A 4-bit binary code is normally capable of representing sixteen different states with a Hamming distance equal to 1. Momentarily setting aside questions of efficiency, the same sixteen states can also be represented in a 7-bit code at triple the Hamming distance, as shown in table 2. Again, referring to table 1, a Hamming distance of 3 facilitates single-error correction. Encoding in 7 bits is accomplished by performing three distinct parity checks on the 4 data bits. Details of the three parity checks are summarized in table 3 and diagrammed in figure 3.

It should be understood that the actual encoded form of each symbol is irrelevant and need not be known. When no error is present, decoding of the 7-bit word will reset all three parity checks to logic 0, and will restore the data to its original form. The error-handling process is demonstrated in figure 4. With an error in the third data bit, the parity-decoding procedure flags a fault code of 110, which in table 4 is seen to correspond uniquely to an error in data position 3.

Circle 186 on inquiry card.

THE BRAND NEW
EXCEL TX-80
DOT MATRIX PRINTER



PRICES
TOO LOW
TO ADVERTISE

STANDARD FEATURES:

- 80 columns on plain paper with adjustable paper width
- 150 Characters per second (70 LPM) throughput
- 7X5 dot matrix, 96 ASCII set (upper & lower case) plus 7X6 dot matrix PET's* graphic set
- Centronics compatible parallel interface plus your choice of a TRS-80*, Apple II*, IEEE 488 or RS232C IF
- Microprocessor control with 2716 EROM character set
- Double width elongated printing for labels
- New improved sound dampening foam lined casing
- Tractor Feed & Friction Feed Version not interchangable
- 90 days warranty for parts and labor

OPTIONAL INTERFACE BOARDS & CABLE SETS:

- PET/CMB*, 2K Buffer/RS232C, Loadable RAM full graphics interface available at extra cost
- Cable sets for each interface are at extra cost

CALL or SEND for free brochure & price list.

TERMS:
• Checks, Master Charge and Visa accepted • Allow up to 4 weeks for delivery • Please add $15 per printer for shipping & handling • Calif residents add 6% sales tax

EXCEL COMPANY
MICRO COMPUTER SYSTEMS
618 GRAND AVENUE
OAKLAND, CALIF. 94610
(415) 465-4240

We are the original PET* Keyboard Interface people

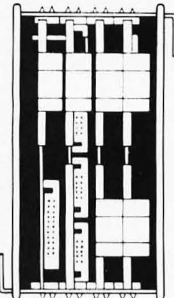
*Trade Marks of Commodore, Apple & Tandy Corp.

Circle 187 on inquiry card.

DEC LSI-11 Components

Dependable service at discount prices

Domestic
and Export



Mini Computer Suppliers, Inc.
25 Chatham Rd., Summit, N.J. 07901
Since 1973
(201) 277-6150 Telex 13-6476

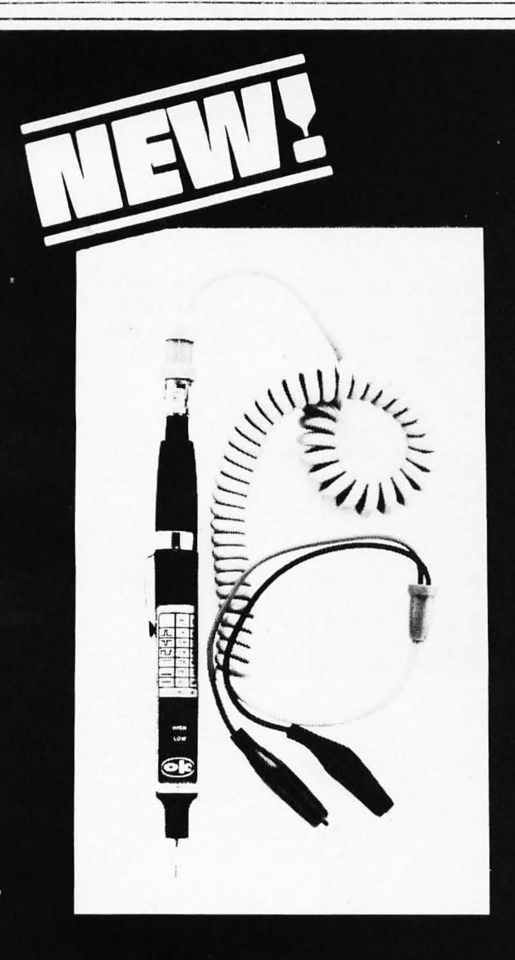
©Mini Computer Suppliers, Inc. 1979



NEW!



PRB-1 DIGITAL LOGIC PROBE



Compatible with DTL, TTL, CMOS, MOS and Microprocessors using a 4 to 15V power supply. Thresholds automatically programmed. Automatic resetting memory. No adjustment required. Visual indication of logic levels, using LED's to show high, low, bad level or open circuit logic and pulses. Highly sophisticated, shirt pocket portable (protective tip cap and removable coil cord).

$36.95*

- **DC to > 50 MHZ**
- **10 Nsec. pulse response**
- **120 K Ω impedance**
- **Automatic pulse stretching to 50 Msec.**
- **Automatic resetting memory**
- **Open circuit detection**
- **Automatic threshold resetting**
- **Compatible with all logic families 4-15 VDC**
- **Range extended to 15-25 VDC with optional PA-1 adapter**
- **Supply O.V.P. to ± 70 VDC**
- **No switches/no calibration**

* ADD $2.00 FOR SHIPPING
(N. Y. CITY AND STATE RESIDENTS ADD TAX)

OK MACHINE & TOOL CORPORATION
3455 Conner St., Bronx, N.Y. 10475 (212) 994-6600 / Telex 125091

Circle 188 on inquiry card.

Admittedly, this does not constitute a true Hamming code, in the sense that the fault code does not display the binary form of the error-bit position within the word. This feature is convenient to implement for the shorter codes, but need not be attempted in the more comprehensive correction schemes where fault-code interpretation can be readily handled in a read-only memory.

Practicality of Use

An overhead of three parity flags for every 4 data bits is undesirable. These techniques become useful only for larger word lengths. Initially, performance increases as the data word length becomes longer, up to N = 31. It is possible to correct single-bit errors in words with 8 data bits and four additional parity flags, an overhead of 50%. Single-error correction of 16 bits requires five flags, an overhead of 32%.

In the case of an 8-bit system, an overhead of 50% may seem exorbitant, but it can pay off rapidly. Assuming that with correcting logic in operation, single errors are virtually nonexistent, it may well be possible to realize a decrease in loading time by a factor of 2, 5 or even 10. It is true that 1.5 times as many bits are being moved into and out of the storage medium, but if the data rate merely doubles, loading times will fall to

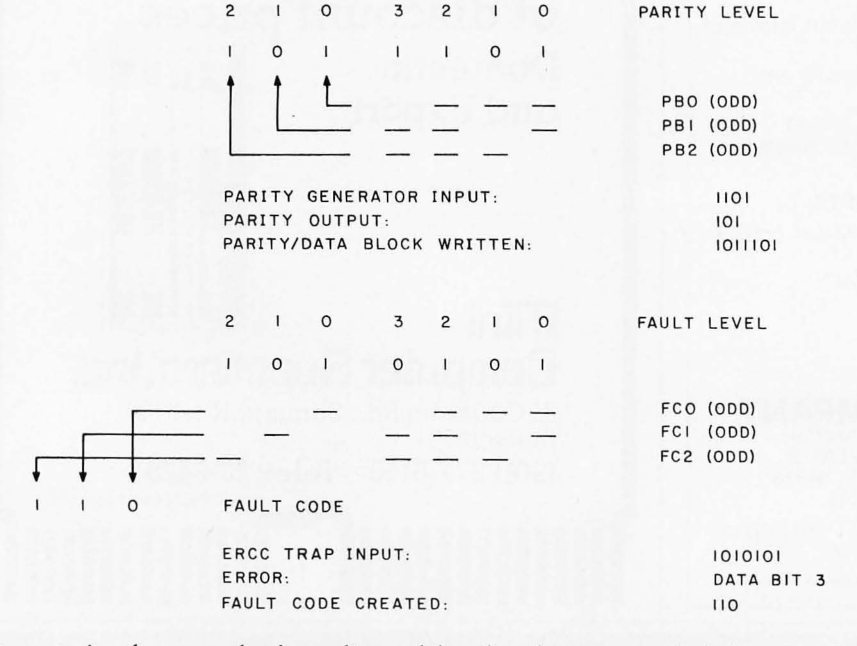
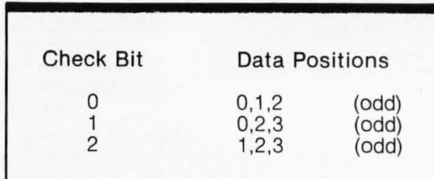


Figure 4: *Another example of encoding and decoding data composed of 4 bits in a 7-bit word. In this case an error has been detected; the fault code of 110 indicates an error in data bit 3.*



Check Bit	Data Positions	
0	0,1,2	(odd)
1	0,2,3	(odd)
2	1,2,3	(odd)

Table 3: *Encoding 4-bit data into 7 bits is done by performing 3 distinct parity checks on the 4 data bits. Each of the 3 check bits corresponds to the parity value of the data positions shown here.*

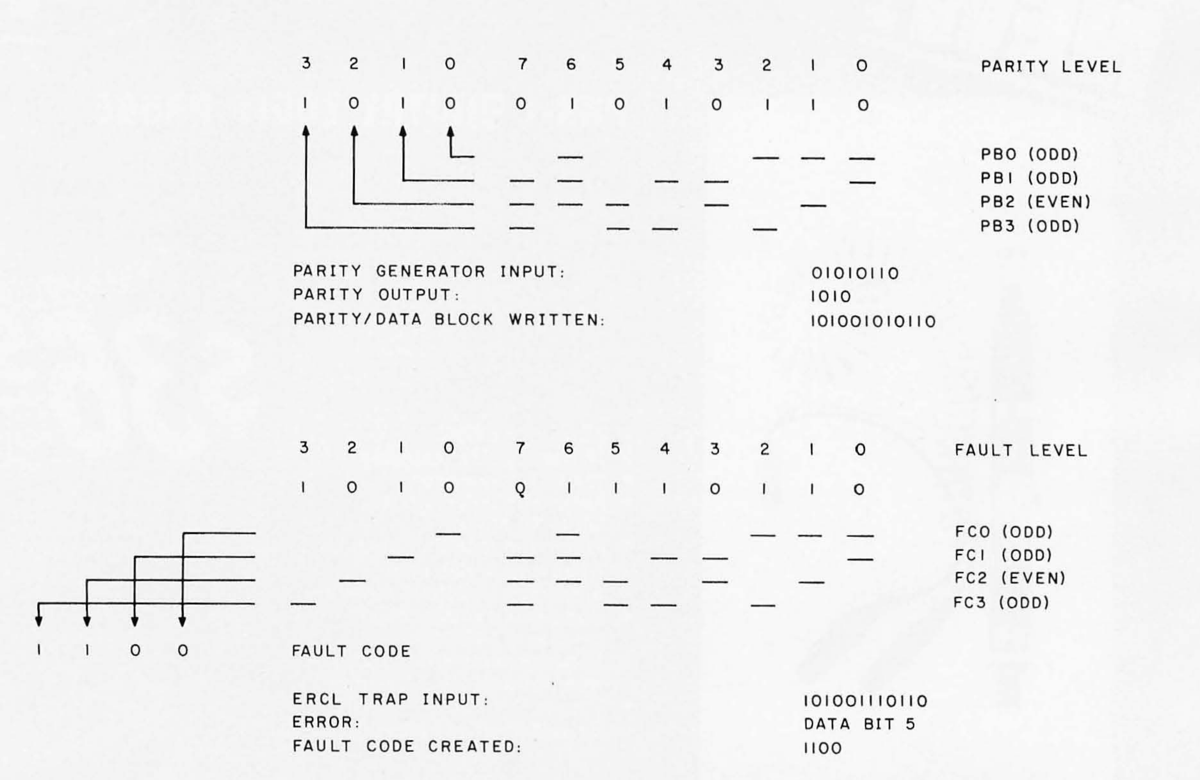
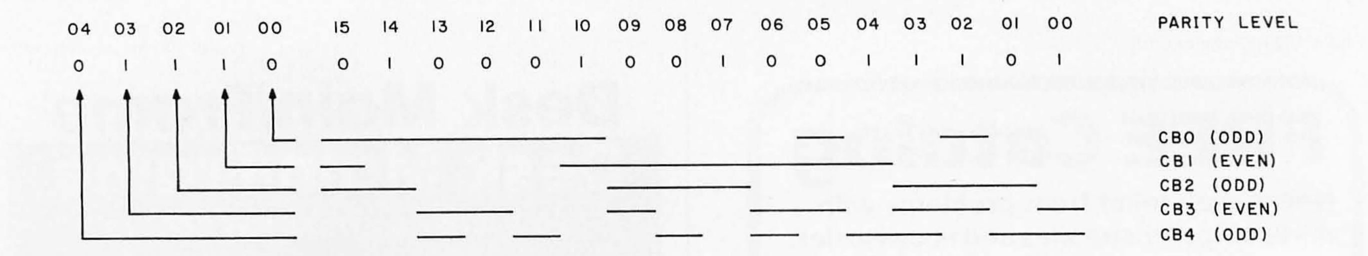


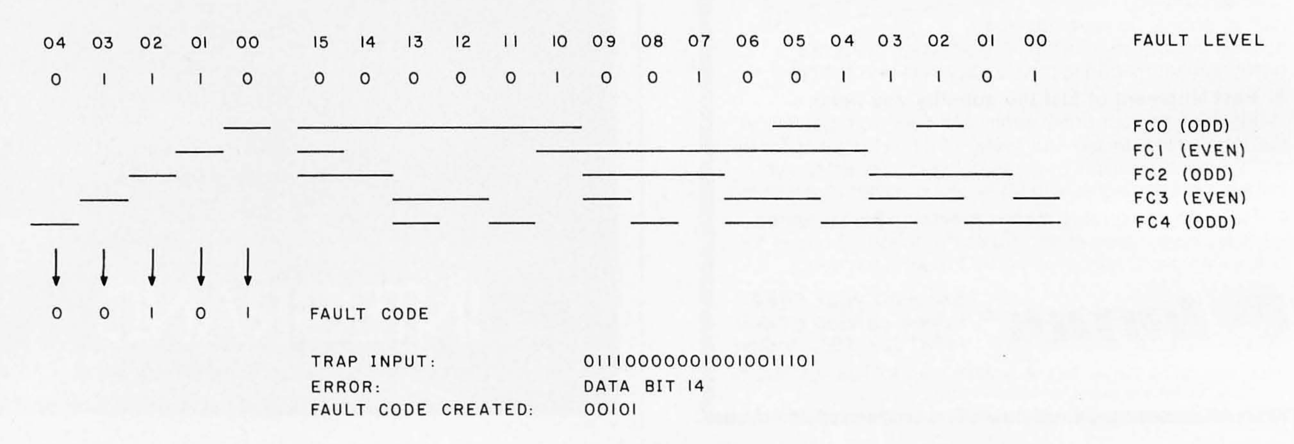
Figure 5: *Encoding and decoding for data consisting of an 8-bit byte. Four bits are used for error checking; the possible fault codes are given in table 6.*

Desk Main/Frame



PARITY GENERATOR INPUT: 0100010010011101
PARITY OUTPUT: 01110
PARITY/DATA BLOCK WRITTEN: 011100100010010011101

Figure 6a: *Encoding of 16-bit data using five bits for error checking; this results in a 21-bit data word being written to the peripheral device. Check bits based on even parity are set to 1 if there are an even number of 1s in the corresponding data-bit group; an odd-parity check bit is set to 1 if the number of 1s in its data-bit group is odd. This figure, figure 6b, and table 8 originally appeared in slightly different form in* Electronics *magazine, November 13, 1975, page 135. Copyright © McGraw-Hill Inc, 1975.*



TRAP INPUT: 011100000010010011101
ERROR: DATA BIT 14
FAULT CODE CREATED: 00101

Figure 6b: *Decoding and checking the 16-bit data, 5-bit parity-check word from figure 6a. Bit 14 has been transmitted erroneously; therefore a fault code of 00101 (reading from check bit 04 to bit 00) is generated. A complete list of possible fault codes is given in table 8 (in reverse order, reading from check bit 00 to bit 04).*

Fault Code	Error
000	no error detected
001	check bit 0
010	check bit 1
011	data bit 0
100	check bit 2
101	data bit 1
110	data bit 3
111	data bit 2

Table 4: *Look-up table of fault codes used by the 4-bit into 7-bit encoding scheme. The fault code tells the error-correcting logic where the error has occurred.*

Encoding for 8 and 16 bits is shown in figures 5 and 6. The detailed parity tests for these appear in tables 5 and 7 respectively. The fault-code look-up tables are shown as tables 6 and 8. This 16-bit system was developed by the Data General Corporation. It will correct single-bit errors throughout the entire word, and will reportedly trap an average of 97% of the multiple faults that occur. Eight-bit coding logic has been verified in macro-assembler routines on a DECsystem 10 by my associate Stephen J Gross, who is now at Stanford University.

Check Bit	Data Positions	
0	0,1,2,6	(odd)
1	0,3,4,6,7	(odd)
2	1,3,5,6,7	(even)
3	2,4,5,7	(odd)

Table 5: *Encoding of 8-bit data requires the use of four parity bits to allow single-bit error correction. The correspondence of each check bit to specific bits within the 8-bit data byte is shown here.*

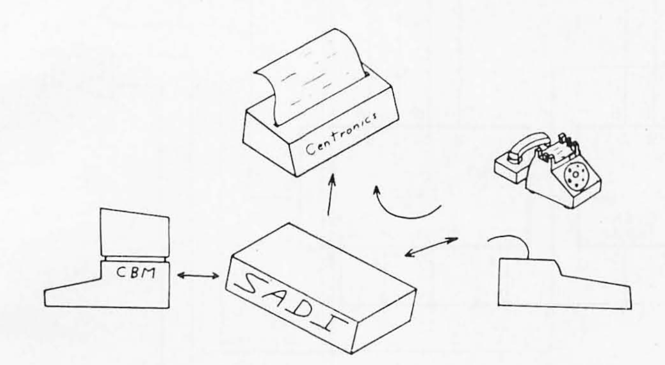
75% of the initial value. A ten-fold increase in data rate decreases loading time by 85%. Sixteen-bit systems are even better suited to the use of error checking and correcting systems (ERCC), though the majority of microprocessors in use today operate with an 8-bit data word.

Error-Reducing Hardware

Hardware implementation utilizes standard 7400 series transistor-transistor logic (TTL). Schematic diagrams are shown in figures 7 and 8. Parity encoding and decoding is accomplished with 9-bit parity trees (using a 74180 parity generator/tester). Worst-case data path for both 8-bit and 16-bit error checking and correcting amounts to about 120 ns delay. Certainly, this interval is short enough to prevent it from imposing any constraint at even unusually high data-transfer rates. It should be clear that when handling errors, operation

Circle 192 on inquiry card.

PET TWO-WAY RS-232 and PARALLEL OUTPUT INTERFACE



SADI - The microprocessor based serial and parallel interface for the Commodore PET. SADI allows you to connect your PET to parallel and serial printers, CRT's, modems, acoustic couplers, hard copy terminals and other computers. The serial and parallel ports are independent allowing the PET to communicate with both peripheral devices simultaneously or one at a time. In addition, the RS-232 device can communicate with the parallel device.

Special Features for the PET interface include:
- Conversion to true ASCII both in and out
- Cursor controls and function characters specially printed
- Selectable reversal of upper and lower case
- PET IEEE connector for daisy chaining
- Addressable - works with other devices

Special Features for the serial interface include:
- Baud rate selectable from 75 to 9600
- Half or full duplex
- 32 character buffer
- X-ON, X-OFF automatically sent
- Selectable carriage return delay

Special Features for the parallel interface include:
- Data strobe - either polarity
- Device ready - either polarity
- Centronics compatible

Complete with power supply, PET IEEE cable, RS-232 connector, parallel port connector and case. Assembled and tested.

SADIa (110VAC) $295
SADIe (230VAC) $325

Order direct or contact your local computer store.

CONNECTICUT microCOMPUTER, Inc.
150 POCONO ROAD
BROOKFIELD, CONNECTICUT 06804
TEL: (203) 775-9659 TWX: 710-456-0052

VISA AND M/C ACCEPTED - SEND ACCOUNT NUMBER, EXPIRATION DATE AND SIGN ORDER.
ADD $3 PER ORDER FOR SHIPPING & HANDLING - FOREIGN ORDERS ADD 10% FOR AIR POSTAGE.

ANNOUNCING: NEW!

MICROSTAT

A complete statistics package for business, scientific, education and research work. No other package has the features of MICROSTAT. For example:

• File oriented with COMPLETE editing • A Data Management Subsystem for editing, sorting, ranking, lagging, data file transfers PLUS 11 data transformations (e.g., linear, reciprocal, exponential, etc.) • Frequency distributions • Simple and multiple regression • Time series (including exponential smoothing) • 11 Non-parametric tests • Crosstabs/Chi-square • Factorials (up to 1,000,000!), permutations, combinations • 8 Probability distributions • Scatterplots • Hypothesis test (Mean, proportion) • ANOVA (one and two-way) • Correlation • Plus many other unique features

Users manual: $10.00 (credited towards purchase) and includes sample data and printouts. Uses NORTH STAR BASIC 32K of memory, one or two disk drives (2 recommended). Printer optional. Price: $200.00



ECOSOFT
P.O. Box 68602
Indianapolis, IN 46268

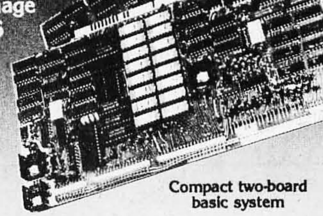
Phone orders:
(317) 253-6828

Circle 193 on inquiry card.

CAT-100 FULL COLOR GRAPHICS

The original 256-color imaging system with high resolution video FRAME GRABBER for the S-100 bus.

Capture and digitize a video frame in 1/60 of a second. Select the best resolution for your application, from 256 to 1280 pixels per TV line. Display your digitized or computer processed image with 256 gray levels or 256 colors on standard B&W, NTSC or RGB color TV monitors.



Compact two-board basic system



240x256 Digitzed image, 16 levels

480x512 Computer-generated

Features:
- Highest possible quality 480x512x8 digital video image presently available on the market
- Input capability from TV camera or other sources
- Variety of synchronization choices
- 2 selectable video A/D conversion circuits
- Choice of 1, 2, 4, 8, 16 or 32 bits per pixel
- 32K-byte image memory on the basic system
- 32, 64, 128 & 256K byte system capacity
- Lightpen input
- Photographic trigger control input
- Software selectable system parameters
- Interfaces for TRS-80 and other processors
- Comprehensive line of accessories, monitors and support software

SEND FOR FREE CATALOG



DIGITAL GRAPHIC SYSTEMS
441 California Ave., Palo Alto, CA 94306 415/494-6088

Circle 194 on inquiry card.

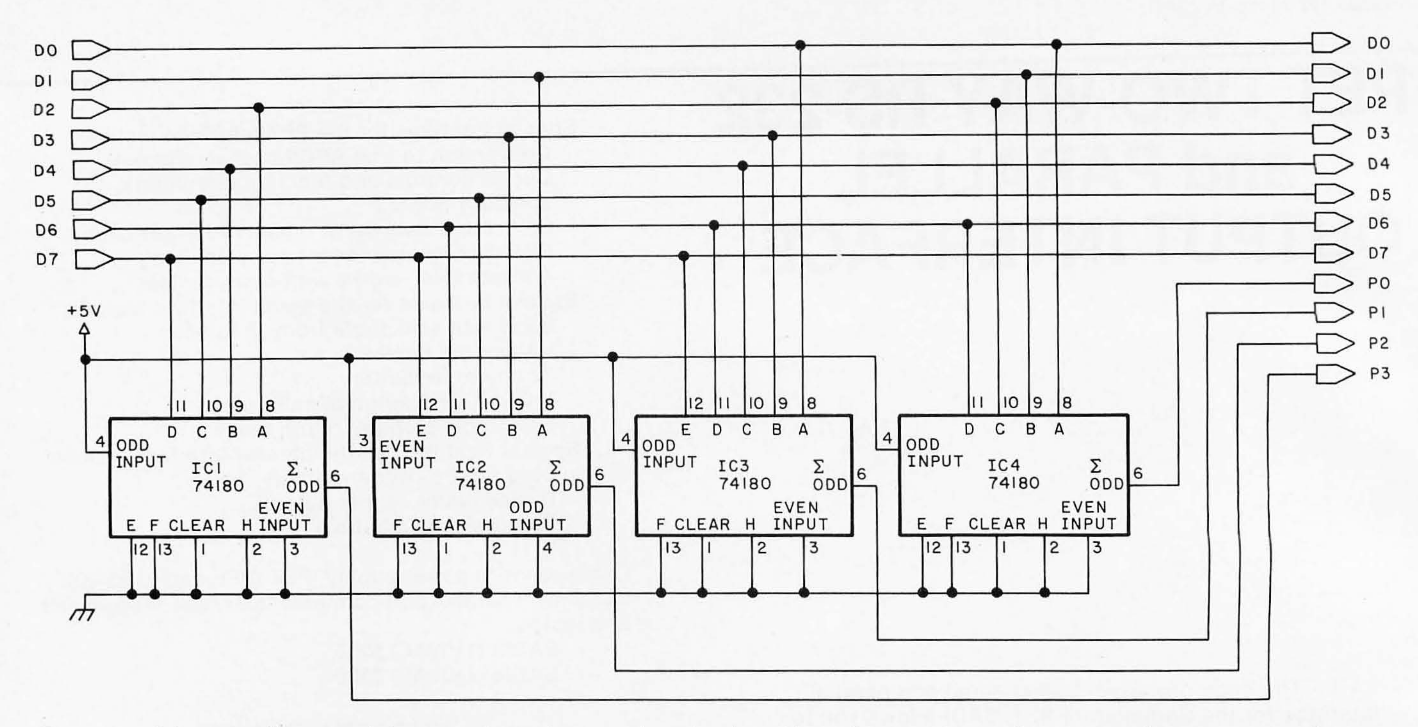


Figure 7a: *Schematic diagram of electronic logic that encodes 8-bit data. Unused input pins on the 74180 parity-generator and tester devices are connected to ground.*

Figure 7b: *Schematic diagram of circuit for trapping errors in the 8-bit data encoded by the circuit in figure 7a. The 12-bit word received from the peripheral device is separated into 8 bits of meaningful data and 4 bits of parity-checking data. Unused inputs on the 74180s are grounded.*

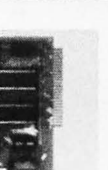
of the error checking and correcting apparatus is rapid enough to make it entirely transparent to the processor and the system bus.

Though the underlying theory requires the writing of additional parity bits, the generation and interpretation of these flags are contained entirely within the error-processing system. (See figure 9.) The parity bits do not appear on the bus and are not seen by the processor; therefore no interface modification is necessary. Additional data-transfer logic is required to deal with the parity bits. The circuits in figures 7 and 8 create parallel data which must undergo a

Text continued on page 274

Circle 195 on inquiry card.

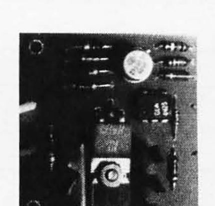
APPLE II PARALLEL INTERFACE CARD



John Bell Engineering is announcing an Apple II Parallel Interface Card. There are four I/O ports with handshaking logic. The board has two 6522 versatile interface adapters and a 74LS74 for addressing and timing. Each 6522 has two interval timers. This will interface your Apple II to printers, speech synthesizers, keyboards, and other John Bell Engineering products. Inputs and outputs are TTL and CMOS compatible.

Prices:
79-295 Complete kit $69.95
79-295 Assembled $79.95

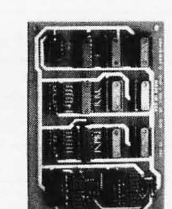
SOLID STATE SWITCH



Now you can control the World! Switch lights on and off for home security, computer controlled disco light shows. Turn your printer on only when needed. The Switch can handle 720 watts (120 VAC 6 AMPS). Its input is TTL compatible (5V-2MA), isolation 1500VDC. The circuit board is 2" square on the one channel kit and 2"x 8" on the 4 channel unit.

Prices:
1 Channel kit $9.95 assm. $12.50
4 Channel kit $34.95 assm. $44.95

A to D D to A CONVERTER



John Bell Engineering now has available an Analog to Digital and Digital to Analog Converter Board. Featues low cost medium speed (50,000 conversions per second) for applications such as speech recording and music synthesizing. Single power (+5) required. Parallel inputs and outputs include 8 data bits, strobe lines, and latches. Analog inputs and outputs are medium impedance zero to five volt range.

Prices:
79-287 Kit $49.95
79-287 Assembled $69.95

PRODUCTS AVAILABLE FROM:

JOHN BELL ENGINEERING
P.O. BOX 338
DEPT. 4
REDWOOD CITY, CA 94064
(415) 367-1137

ADD 6% SALES TAX IN CALIFORNIA AND $1.00 SHIPPING & HANDLING FOR ORDERS LESS THAN $20. ADD 4% FOR VISA OR M.C.

J B ENGINEERING

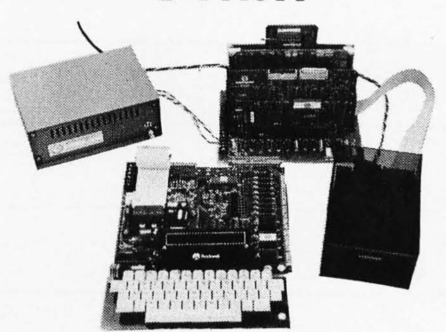
Circle 196 on inquiry card.



compas
microsystems

There is nothing like a

DAIM



A complete disk system for the Rockwell Aim 65. Uses the Rockwell Expansion Motherboard. Base price of $850 (U.S.) includes controller with software in Eprom, disk power supply and one packaged Shugart SA400 Drive.

224 SE 16th St.
P.O. BOX 687

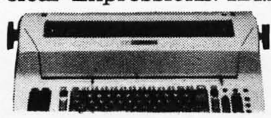
AMES, IA 50010
(515) 232-8187

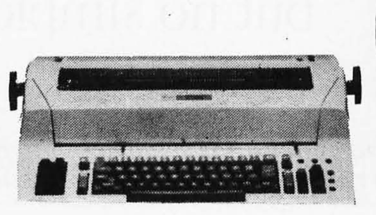
BLINK.

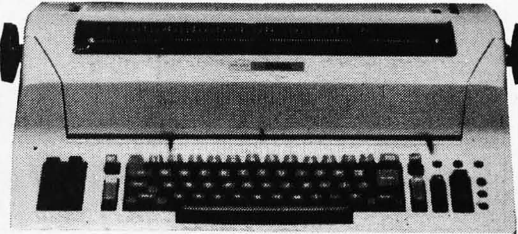
At first it appears to be an IBM Selectric™. It is! A standard keyboard, familiar operation that does such a good job on day-to-day typing. Look, closer. There are extra controls: CONTROL ESCAPE DELETE REPEAT ABORT TEST. The full functions of a communications terminal. It is! Connect the cable to your system's RS232C connector and quick as a blink you can communicate. Input and receive? That's right. It's a printer, too. And, what a printer! Sharp, neat, clear impressions. IBM Selectric™ quality, whether typed by hand or by your computer. Typewriter yes, communicator yes, printer yes. All three beautifully packaged in a single machine for $1595.

Buy one, today, and expand your present system with the flick of a switch. In the blink of an eye.

Western I/O







Western I/O 7750 E. Redfield Road Scottsdale, Arizona 85260 Area Code (602) 948-3162

Circle 197 on inquiry card.

Figure 7c: *Schematic diagram of the circuit which corrects single-bit errors trapped by the circuit of figure 7b. Multiple-bit errors are made known to the processor, but cannot be corrected using this scheme.*

Circle 199 on inquiry card.

TERMINALS
FROM TRANSNET

PURCHASE FULL OWNERSHIP AND LEASE PLANS

DESCRIPTION	PURCHASE PRICE	PER MONTH 12 MOS.	24 MOS.	36 MOS.
LA36 DECwriter II	$1,695	$162	$ 90	$ 61
LA34 DECwriter IV	1,295	124	69	47
LA120 DECwriter III KSR	2,495	239	140	90
LA180 DECprinter I	2,095	200	117	75
VT100 CRT DECscope	1,895	182	101	68
VT132 CRT DECscope	2,295	220	122	83
DT80/1 DATAMEDIA CRT	1,895	182	101	68
TI745 Portable Terminal	1,595	153	85	57
TI765 Bubble Memory Terminal	2,795	268	149	101
TI810 RO Printer	1,895	182	101	68
TI820 KSR Printer	2,195	210	117	79
TI825 KSR Printer	1,695	162	90	61
ADM3A CRT Terminal	875	84	47	32
QUME Letter Quality KSR	3,195	306	170	115
QUME Letter Quality RO	2,795	268	149	101
HAZELTINE 1410 CRT	875	84	47	32
HAZELTINE 1500 CRT	1,195	115	64	43
HAZELTINE 1552 CRT	1,295	124	69	47
DataProducts 2230 Printer	7,900	757	421	284
DATAMATE Mini Floppy	1,750	168	93	63

FULL OWNERSHIP AFTER 12 OR 24 MONTHS • 10% PURCHASE OPTION AFTER 36 MONTHS

ACCESSORIES AND PERIPHERAL EQUIPMENT

ACOUSTIC COUPLERS • MODEMS • THERMAL PAPER
RIBBONS • INTERFACE MODULES • FLOPPY DISK UNITS

PROMPT DELIVERY • EFFICIENT SERVICE



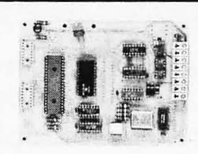
TransNet Corporation
1945 ROUTE 22, UNION, N.J. 07083
201-688-7800
TWX 710-985-5485

Circle 200 on inquiry card.

CONTROL THE WORLD THROUGH A EIA RS-232C PORT







ALI has designed a new control system that uses a standard serial port to communicate to over 1000 output points and read over 1000 input points. With this system you can now control relays, lights, motors, D/A, and sense photo eyes, voltage, switches, A/D, keyboards and a lot more. All this control over a single RS-232C link! All it takes is a standard RS-232C port and one or more ALI control modules, per your I/O requirement. Up to 225 modules can be connected to a single EIA RS-232C port.

The modules consist of an I/O CONTROL COMMANDER by itself or in conjunction with one of the specific I/O interface boards. Each I/O CONTROL COMMANDER has 8 TTL inputs and 4 TTL outputs, plus all of the circuitry necessary for proper address decoding and communications timing. Each CONTROL COMMANDER is crystal controlled for highest accuracy and reliability. Baud rate is selectable from 150 to 9600 baud.

Various peripherals can be plugged into the I/O CONTROL COMMANDER to handle specific I/O functions.

	ASSM	KIT
I/O CONTROL COMMANDER • 8 TTL inputs • 4 TTL outputs • 150 to 9600 Baud • Crystal controlled	$149	$129
RELAY INTERFACE • 4 2A, 120V AC relay outputs • 4 5V-120V AC or DC opto-isolated inputs	120	98
UNIVERSAL I/O, KEYBOARD DISPLAY INTERFACE • Up to 16 character display • Up to 32 digits display • Up to 64 individual inputs • Sense full ASCII keyboard • Up to 128 individual outputs	190	152
ALPHA NUMERIC DISPLAY • 16 Alpha numeric displays • Mates with UVKD	179	155
THUMBWHEEL SWITCH UNIT • 8 Digits BCD inputs • 32 Bits TTL input • Mates with UVKD	165	145

As you can see from the above description, you can mix and match modules to meet your specific requirements. All this and more over a single RS-232C link. The above is only a brief summary of the available options.

TO ORDER CALL OR WRITE:



AL INDUSTRIES
15 Algonquin Trail, Oakland, N.J. 07436
(201) 337-2030

*N.J. Residents add 5% sales tax • Dealers Inquiries Invited



INFINITE BASIC
For MOD I TRS-80™ Tape and Disk Systems

Extensions to Level II and Disk BASIC $49.95

Full MATRIX Functions — 30 BASIC commands!! Mathematical and common matrix functions. Change arrays in mid-program. Complete array handling. Tape array read and write, including strings. Common subroutine calls.

Over 50 more STRING Functions as BASIC commands!! String manipulation, translation, compression, copying, search, screen control, pointer manipulation and utility functions. Includes multikey multivariable machine language sorts. Load only machine language functions that you want! Where you want in memory! Relocating linking loader! More than you ever expected!!

∞ BUSINESS (Requires Infinite BASIC) $29.95

20 Business oriented functions including:
Printer Automatic Pagination with headers and footers!
Packed Decimal Arithmetic (+,-,*,/) 127 digits!
Binary array searches and hash code generator!

COMPROC Command Processor for Disk Systems $19.95

Auto your disk to perform any sequence of DOS commands, machine language loads, BASIC, memory size, run program, respond to input statements, etc. Single BASIC command file defines execution! Includes auto key-debounce, screen print and lower case software driver.

REMODEL + PROLOAD Specify 16, 32, or 48K Memory $34.95

REnumber any portion or all of BASIC program. MOve any portion of program from one location to another. DELete program lines. MERGE all or any portion from tape. Save and verify portion or all of combined merged programs to tape.

GSF (Specify 16, 32, or 48K) $24.95

18 Machine language routines. Includes RACET sorts.

DISK SORT MERGE 'DSM'
For MOD I and MOD II TRS-80™

FAST → Now you can sort an 85K diskette in less than 3 minutes* ← FAST

Perfect for your multi-diskette RANDOM file mailing lists, inventory, etc. Ideal for specialized report generation. Sort, merge or combination. All machine language stand-alone package — Efficient and easy to use. No separate key files required! Physical records are rearranged on diskette! Supports multiple sub records per sector including optional sector spanning. Sorts on one or more fields — ascending or descending. Sort fields within records may be character, integer, and floating-point binary. Provides optional output field deletion, rearrangement, and padding.

*Sort timings shown below are nominal times. Times will vary based on sort and system configurations. Nominal times based on Mod I 48K 4-drive configuration, 64 byte records, and 5 sort keys.

TYPE	FILE SIZE (Bytes)	SORT TIME (Sec)	TYPE	FILE SIZE (Bytes)	SORT TIME (Sec)
SORT	16K	33	SORT	340K	1081
SORT	32K	49	SORT	680K	2569
SORT	85K	173	SORT and MERGE	85K SORT + 1275K Merge	1757
SORT	170K	445			

DSM for Mod I (Minimum 32K, 2-drives) **$75 On-Disk**
DSM for Mod II (Minimum 64K, 1-drive) **$150 On-Disk**

Mod II Development Package $100
Machine Language SUPERZAP, plus Editor/Assembler and Disassembler patches.

Mod II Generalized Subroutine Facility 'GSF' $50

CHECK, VISA, M/C, C.O.D.
Calif. Residents add 6%
Telephone Orders Accepted (714) 637-5016

DEALER INQUIRIES INVITED
WHEN ORDERING PLEASE ADVISE PUBLICATION SOURCE

RACET COMPUTES
702 Palmdale, Orange CA 92665

Circle 201 on inquiry card.

Fault Code	Error
0000	no error detected
0001	check bit 0
0010	check bit 1
0011	data bit 0
0100	check bit 2 *
0101	data bit 1
0110	data bit 3
0111	data bit 6
1000	check bit 3
1001	data bit 2
1010	data bit 4
1011	all data and parity set to logic 0
1100	data bit 5
1101	multi bit error
1110	data bit 7
1111	multi bit error

Table 6: *Look-up table of fault codes used by the 8-bit to 12-bit encoding scheme. Setting of the check-bit-2 fault code (indicated by an asterisk) shows that all data and parity bits are set to logic 1.*

Check Bit	Data Positions	
0	2,5,10,11,12,13,14,15	(odd)
1	4,5,6,7,8,9,10,15	(even)
2	1,2,3,7,8,9,14,15	(odd)
3	0,2,3,5,6,9,12,13	(even)
4	0,1,3,4,6,8,11,13	(odd)

Table 7: *The 16-bit encoding scheme uses 5 parity bits that enable single-bit error correction. Each parity-check bit performs its check operation upon the data-bit positions shown here.*

Fault Code	Error
00000	no error detected
00001	error in check bit 4
00010	error in check bit 3
00011	error in data bit 0
00100	error in check bit 2
00101	error in data bit 1
00110	multiple-bit error
00111	error in data bit 3
01000	error in check bit 1
01001	error in data bit 4
01010	all data and parity set to logic 1
01011	error in data bit 6
01100	error in data bit 7
01101	error in data bit 8
01110	error in data bit 9
01111	multiple-bit error
10000	error in check bit 0
10001	error in data bit 11
10010	error in data bit 12
10011	error in data bit 13
10100	error in data bit 14
10101	all data and parity set to logic 0
10110	error in data bit 2
10111	multiple-bit error
11000	error in data bit 10
11001	multiple-bit error
11010	error in data bit 5
11011	multiple-bit error
11100	error in data bit 15
11101	multiple-bit error
11110	multiple-bit error
11111	multiple-bit error

Table 8: *Look-up table of fault codes used by the 16-bit to 21-bit encoding scheme. The codes are shown here in order from check bit 00 to bit 04, reversed from the representation in figure 6.*

Address Input	Data Output							
	7	6	5	4	3	2	1	0
00000	0	0	0	1	0	0	0	0
00001	0	1	0	1	0	0	0	0
00010	0	1	0	1	0	0	0	0
00011	0	0	0	0	0	0	0	0
00100	0	1	0	1	0	0	0	0
00101	0	0	0	0	0	0	0	1
00110	0	0	1	1	0	0	0	0
00111	0	0	0	0	0	0	1	1
01000	0	1	0	1	0	0	0	0
01001	0	0	0	0	0	1	0	0
01010	1	1	0	1	0	0	0	0
01011	0	0	0	0	0	1	1	0
01100	0	0	0	0	0	1	1	1
01101	0	0	0	0	1	0	0	0
01110	0	0	0	0	1	0	0	1
01111	0	0	1	1	0	0	0	0
10000	0	1	0	1	0	0	0	0
10001	0	0	0	0	1	0	1	1
10010	0	0	0	0	1	1	0	0
10011	0	0	0	0	1	1	0	1
10100	0	0	0	0	1	1	1	0
10101	1	0	1	1	0	0	0	0
10110	0	0	0	0	0	0	1	0
10111	0	0	1	1	0	0	0	0
11000	0	0	0	0	1	0	1	0
11001	0	0	1	1	0	0	0	0
11010	0	0	0	0	0	1	0	1
11011	0	0	1	1	0	0	0	0
11100	0	0	0	0	1	1	1	1
11101	0	0	1	1	0	0	0	0
11110	0	0	1	1	0	0	0	0
11111	0	0	1	1	0	0	0	0

Table 9: *Truth table which is programmed into a programmable read-only memory for use in the electronic circuit of the 16-bit error-checking and correcting system.*

Number	Type	+5 V	GND
IC1	74180	14	7
IC2	74180	14	7
IC3	74180	14	7
IC4	74180	14	7
IC5	74180	14	7
IC6	74180	14	7
IC7	74180	14	7
IC8	74180	14	7
IC9	7486	14	7
IC10	7486	14	7
IC11	7404	14	7
IC12	7404	14	7
IC13	7420	14	7
IC14	74154	24	12
IC15	74180	14	7
IC16	74180	14	7
IC17	74180	14	7
IC18	74180	14	7
IC19	74180	14	7
IC20	7404	14	7
IC21	74180	14	7
IC22	74180	14	7
IC23	74180	14	7
IC24	74180	14	7
IC25	74180	14	7
IC26	7488	16	8
IC27	74154	24	12
IC28	7404	14	7
IC29	7404	14	7
IC30	7404	14	7
IC31	7486	14	7
IC32	7486	14	7
IC33	7486	14	7
IC34	7486	14	7

Table 10: *Power supply connections for integrated circuits used in electronic logic described in this article.*

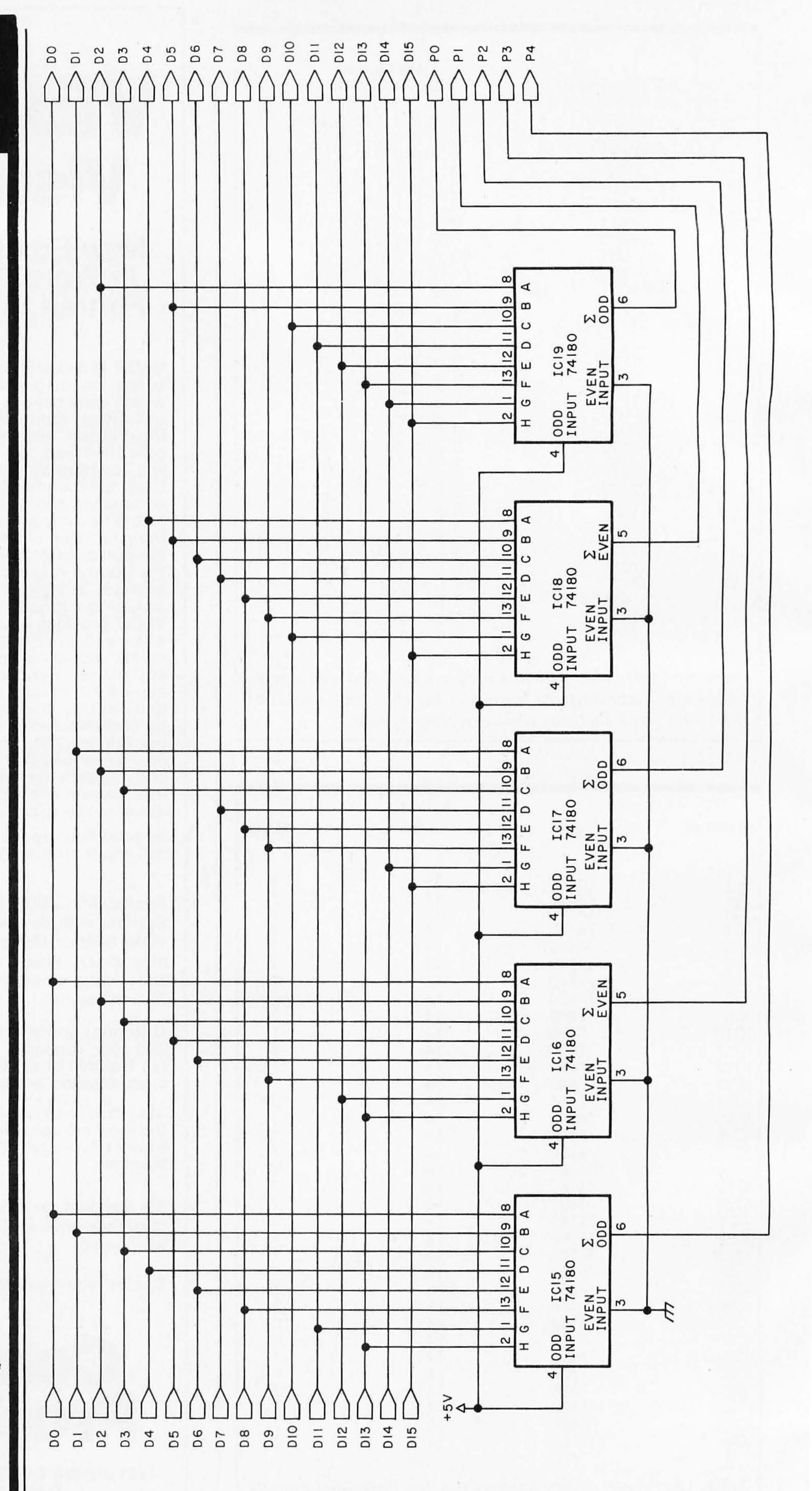


Figure 8a: *Schematic diagram of the circuit to encode 16-bit data into 21-bit words containing 5 parity bits.*

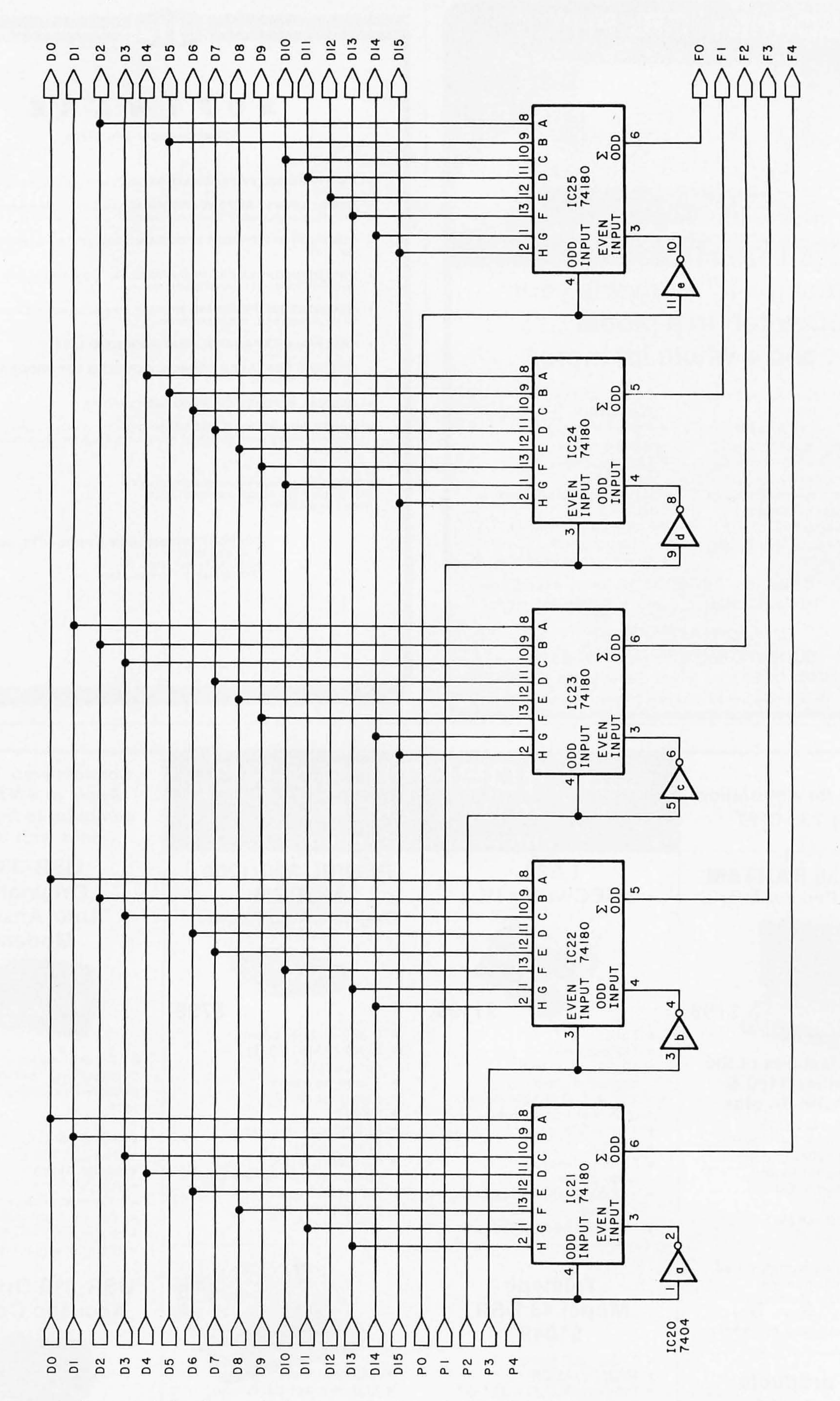
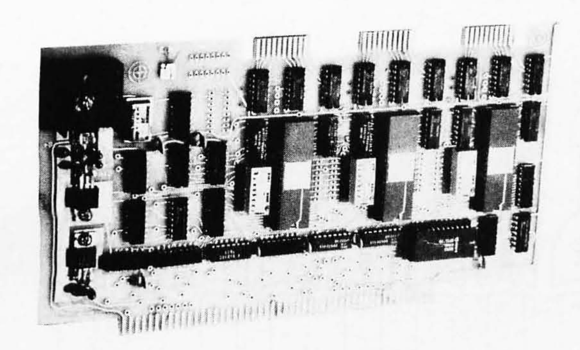


Figure 8b: *Schematic diagram of the circuit which traps errors from the encoded 16-bit data. Five error-detecting bits are sent to the error-correcting circuit of figure 8c.*

Circle 208 on inquiry card.

S-100, 6-PORT COMMUNICATIONS



- INTERFACES MULTI TERMINALS, COMPUTERS, PRINTERS, MODEMS, ETC.
- 2, 4, OR 6 CHANNELS; 2 OPTIONAL RTC'S
- SELECTABLE I/O ADDRESS
- PROGRAMMABLE SYNC. CHARACTERS
- SYNC AND ASYNC
- HARDWARE ERROR CHECKING (CRC-16, CCITT)
- COMPLIES WITH: EIA RS-232C STANDARD; IEEE PROPOSED S-100 BUS STANDARD

FULL 6-PORT CONFIGURATION (ASSEMBLED AND TESTED) $895.00

For information, contact: Dianne Polk (703) 893-4330 x 100



Inco, Inc.

7916 Westpark Drive □ McLean, Virginia 22102

Circle 209 on inquiry card.



BUSINESS & PROFESSIONAL SOFTWARE FOR APPLE II

□ **HOME FINANCE PAK I: Complete package $49.95**

□ BUDGET: The heart of a comprehensive home finance system. Allows user to define up to 30 budget items. Actual expense input can be by keyboard or by automatic reading of CHECKBOOK II files. Costs are automatically sorted and compared with budget. BUDGET produces both monthly actual/budget/variance report and a year-to-date by month summary of actual costs. Color graphics display of expenses by month. $24.95

□ CHECKBOOK II: This extensive program keeps complete records of each check/deposit. Unique check entry system allows user to set up common check purpose and recipient categories. Upon entry you select from this pre-defined menue to minimize keying in a lot of data. Unique names can also be stored for completeness. This system produces rapid access to check files. Check register display incorporates unique up/down scrolling system for the ultimate in flexibility. 40 column printout of check register. Up to 100 checks per month storage. Files accessible by BUDGET program $14.95

□ SAVINGS: Allows user to keep track of deposits/withdrawals for up to 10 savings accounts. Complete records shown via screen or 40 column printer. $14.95

□ CREDIT CARD: Keep control of your cards with this program. Organizes, stores and displays purchases, payments and service charges. Screen or 40 column printer display. Up to 10 separate cards $14.95

□ **THE UNIVERSAL COMPUTING MACHINE: $39.95**
A user programmable computing system structured around a 15 row by 30 column table. User defines row and column names and equations forming a unique computing machine. Table elements can be multiplied, divided, subtracted or added to any other element. User can define repeated functions common to a row or column greatly simplifying table setup. Hundred of unique computing machines can be defined, used, stored and recalled, with or without old data, for later use. Excellent for sales forecasts, engineering design analysis, budgets, inventory lists, income statements, production planning, project cost estimates-in short for any planning, analysis or reporting problem that can be solved with a table. Unique curser commands allow you to move to any element, change its value and immediately see the effect on other table values. Entire table can be printed by machine pages (user-defined 3-5 columns) on a 40 column printer. Transform your computer into a UNIVERSAL COMPUTING MACHINE.

□ **COLOR CALENDAR:** HI-RES color graphics display of your personal calendar. Automatic multiple entry of repetitive events. Review at a glance important dates, appointments, anniversaries, birthdays, action dates, etc. over a 5 year period. Graphic calendar marks dates. Printer and screen display a summary report by month of your full text describing each day's action item or event. Ideal for anyone with a busy calendar $19.95

□ **MICROACCOUNTANT:** The ideal system for the small cash business. Based on classic T-accounts and double-entry bookkeeping, this efficient program records and produces reports on account balances, general ledger journals, revenue and expenses. Screen or 40 column printer reports. Handles up to 500 journal entries per period, up to 100 accounts. Program instructions include a short primer in Financial Accounting $49.95

□ **THE MATHEMATICIAN: Complete package $39.95**

□ MATRIX: A general purpose utility program for computing the determinant or inverse of a matrix, as well as the solution to an N-Dimensional set of linear equations $14.95

□ PLOTTER 2D: Two dimensional plotting of any function $9.95

□ PLOTTER 3D: Three dimensional surface plotting of any 3-variable function, using Apple II HI-RES $14.95

□ ROOTS: A general purpose program for numerically finding the solutions to any non-linear equation. Uses quadratic interpolation $14.95

SEND FOR FREE CATALOG – All programs run on 32K Apple II with Disc and Applesoft ROM Card, or 48K without ROM Card. Detailed instructions included with each program. California residents add 6½% sales tax. Send check or money order to:

SPECTRUM SOFTWARE

P.O. BOX 2084 – SUNNYVALE, CALIFORNIA 94087

Circle 210 on inquiry card.

FOR SERIOUS USERS

OF 8080, 8085, OR Z80 COMPUTERS

PRINTER WIZARD – Now add powerful capabilities to your printer. Free your computer for use while simultaneously printing backlogged output on a first-in-first-out basis. Transparent operation without noticable slowing of the computer. Allows continuous computer and printer operation on programs having sporadic output. Will backlog up to 100 pages when used with a disk system. Adds optional automatic paging with numbers, adjustable margins on 4 sides, indented overflow lines. Occupies less than 2½ K.

	EX80M103	$45.00
Documentation only	EX80M103D	$ 7.50

DISASSEMBLER – Disassemble machine code into standard source language. Modify or relocate existing programs such as DOS or BASIC using your existing assembler (not included). Disassembles any 8080, 8085, or Z80 code, including embedded data blocks and "trick" codes. Generates symbol and label tables.

	EX80M217	$75.00
Documentation only	EX80M217D	$12.50

ALL EXCOM products are fully supported and warranted indefinitely against original defects. Available on single or double density NORTHSTAR 5¼" diskettes, 300 or 1200 baud cassettes (specify). Washington residents add 5.3% tax.

EXCOM

P.O. Box 1802 Bellevue, Washington 98009 U.S.A.

Telephone (206) 641-6577

Circle 211 on inquiry card.

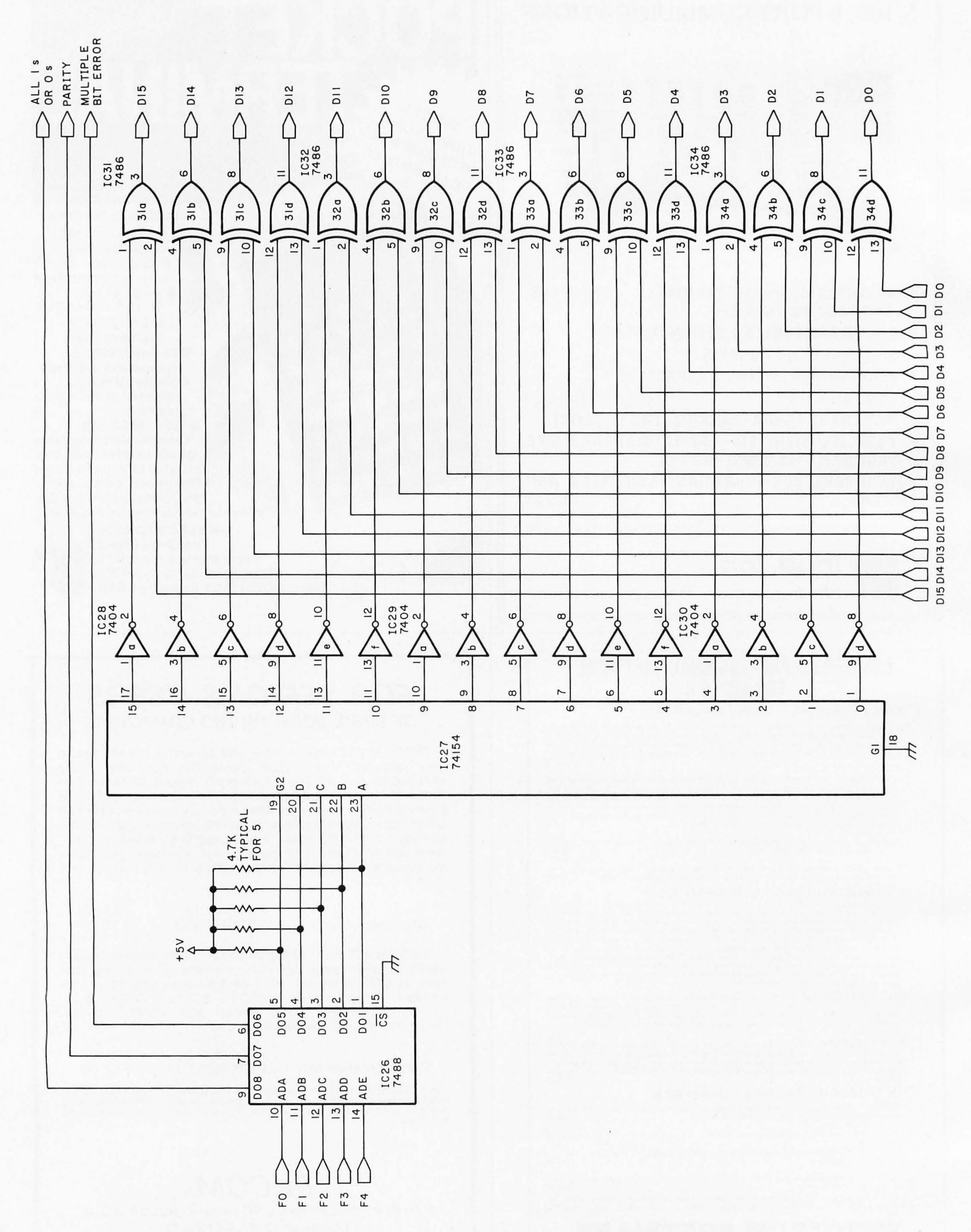


Figure 8c: *Schematic diagram of electronic logic that corrects errors in 16-bit data.*

Text continued from page 262:
parallel-to-serial conversion during a write operation, and a serial-to-parallel conversion during a read process. Details of this hardware will depend upon the actual data-transfer logic present in existing systems.

Locating single errors is accomplished by interpreting the fault code generated by the error-detection logic. This interpretation is done by use of an 8-bit by 32-word programmable read-only memory (8223/7488) which produces a binary output corresponding to the error-bit position in the data word. Error correction is achieved by loading the binary pointer into a 4-to-16 line demultiplexer that flags the proper bit line and corrects the fault with an exclusive-OR inversion. (See figure 10.) With an 8-bit system, the inconvenience of programming the read-only memory may be avoided by loading the fault code directly into the demultiplexer and then "picking off" the corresponding output.

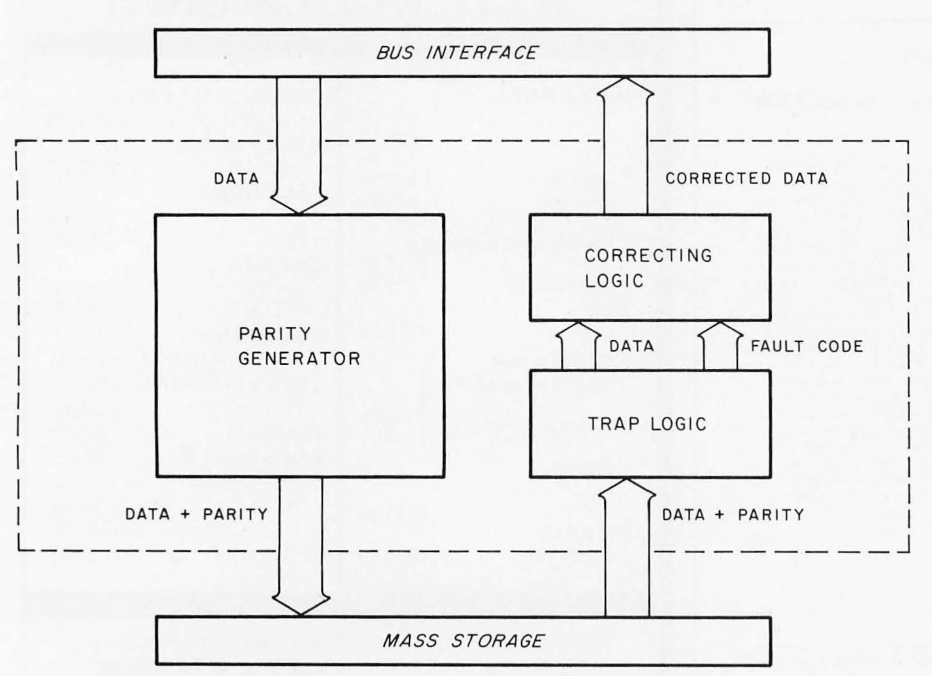


Figure 9: *Block diagram of data flow through the error-checking and correcting system. The extra parity bits are never seen by the processor, and make the system transparent from the point of view of the system bus.*

Treatment of Multiple Errors

Although single-bit errors are far more common, multiple failures within one data word can and do appear. For all intents and purposes, these are uncorrectable— particularly in longer data words. Prohibitively extensive logic would be required to locate multiple-fault bits; therefore, these errors are simply trapped to cause a processor interrupt. The

Circle 217 on inquiry card.

CP/M® SOFTWARE

Word Processing For CP/M

FMT Text Formatter *$75*

Use FMT and your text editor to convert your CP/M system to a powerful word processor. FMT features include automatic page headings and footings, page numbering, centering, underscoring, external file merging, and in-line console input. FMT works with any video, CRT, or hardcopy terminal and printer combination. Added capabilities for daisy-wheel printers: superscripting, subscripting, and half-line spacing.

Run Cromemco Software Under CP/M

ADAPT Software Interface *$50*

Now you can get Cromemco software to run on your CP/M system. ADAPT interfaces those powerful Cromemco packages (except for Multi-User BASIC) to any Z-80 based CP/M system without patching. ADAPT works without changes for any memory size.

Fast RATFOR

RATFOR (RATional FORtran) *$95*

RATFOR lets you write structured code that translates to Microsoft or Cromemco FORTRAN. TSW's RATFOR (RATional FORtran) precompiler runs at more than 1000 statements per minute. Documentation includes "Software Tools" book by Kernighan and Plauger. (ADAPT and RATFOR packages combined $125)

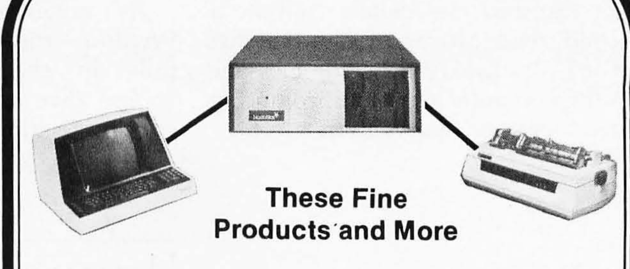


THE SOFTWARE WORKS
8369 Vickers
San Diego, CA 92111
(714) 569-1721

VISA and MasterCharge accepted.

Circle 218 on inquiry card.

TOLL FREE ORDERING



These Fine Products and More

NORTHSTAR	ASM	KIT
HRZ-1-16K-D	1600.	1275.
HRZ-1-32K-D	1995.	1580.
HRZ-2-32K-D	2300.	1900.
HRZ-1-32K-Q	2300.	1750.
HRZ-2-32K-Q	2700.	2230.
RAM-16K	365.	325.
RAM-32K	565.	515.
FPB-A	285.	220.
MDS-A-D	710.	660.
MDS-A-Q	880.	830.
EXTRA DRIVE-D	—	350.
EXTRA DRIVE-Q	—	525.
HARD DISC SYSTEM	CALL	

Most NorthStar computers come standard with real wood cover, 2 serial ports, 1 parallel port, real time clock, disc operating system and NorthStar basic.

TERMINAL	
SOROC IQ-120	760.
HAZELTINE 1400	760.
HAZELTINE 1500	940.
HAZELTINE 1510	1050.
TELEVIDEO 912	700.
TELEVIDEO 920	750.
PRINTERS	
BASE-2	450.
TI-810	1580.
CENTRONICS-799	970.
NEC-5510	2550.
NEC-5520	2800.
SOFTWARE—DISCS—MISC	
AUTOSCRIBE	325.
VERBATUM DISCS (10)	28.
5 FOOT RS-232 CABLE	20.
10 FOOT RS-232 CABLE	25.

WE WILL TRY TO BEAT ANY ADVERTISED PRICE

A. E. I.
4341 W. Commonwealth Ave Suite D
Fullerton, Calif. 92633
(714) 739-4701 (800) 854-6003

CHESS
CP/M CP/M

Sargon for **CP/M** from your **Sargon Book** assembled and patched to run as a **COM File.** Also included, a complete ASCII source file of the original text of the book.

This modified program allows adjourning a game in progress and saving to disk for continuation at a later time. The list of moves for both sides is saved and can be listed to the console or printer for a permanent game record. Powerful new analysis feature allows easier setting up of board positions, changing sides or level during a game, or taking back moves. Terminal non-specific board position display routines. Sargon automatically orients the displayed board so that the player's pieces are always toward him for ease of play. The last 15 moves are constantly displayed with the board position.

This program is written in Z80 Assembler and does not require any interpreters. Runs in as little as a 20K CP/M System.

All this for only **$24.49!**

Custom Graphics Interface, 2 x 3 cell memory mapped video, such as Vector FW II or IMSAI VIO and others. Displays board and pieces in chess graphics for an eye-catching display of the game.

Only **$39.44** Complete with all other above features.

Specify disk type and format.

Any 8" IBM, Micropolis Mod II,
Northstar SD or DD, Cromemco 8" or 5".

Send us your book and a blank disk and we pay return postage.

If you do not have a book

Add $14.95 and we will provide one.
Add $6.00 and we provide the diskette.
California residents add 6% sales tax on book and diskette

ALSO: Personalized **Infosoft IOS Version 2.0.** 100% CP/M*, CDOS*, SDOS* Compatable Disk operating system runs with absolutely any hardware now available. Four years and thousands of hours of use by 8080/Z80 users all over the country.

Standard Features Include:

1. Multiple disk types running simultaneously (all formats 100% lifeboat compatable)
2. **Automatic Print Spooler**
3. Complete set of powerful utilities
4. Inhanced system function calls
5. Fully end-user relocatable
6. File attributes
7. Complete manuals for novice users or experienced programmers

Put an end to CP/M hardware specific limitations at last and save money at the same time with this personalized IOS configuration service.

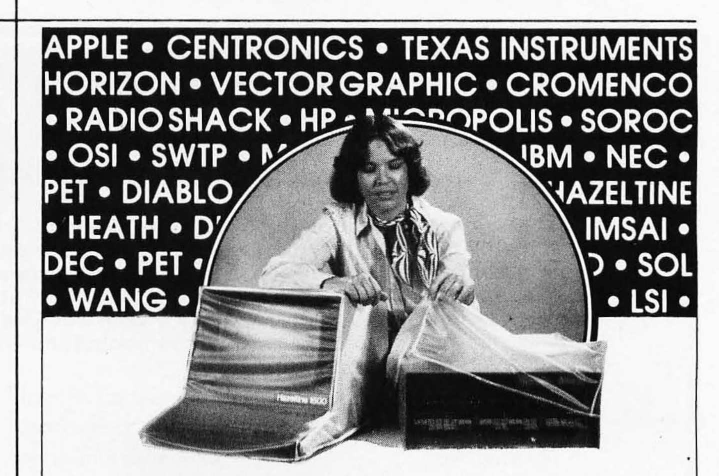
$95 Standard Configuration. (We have thousands of standard configurations) nominal charge for custom I/O and disk drivers.

Infosoft IOS Version 3.0

For hard disks with improved dynamic directory processing and memory management. See Infosoft ad in BYTE. $150.00 configured.

The Old Association
3744 Pescadero Drive
Santa Barbara, Calif. 93105
(805) 682-8587

Circle 219 on inquiry card.



WE'VE GOT YOU COVERED!

Cover Craft Dust Covers protect your hardware and your investment. Save maintenance, downtime and look great. Our Dust Covers come in hundreds of sizes each custom designed to fit a particular model of terminal, CPU, Line Printer, Floppy Disk. They're a proven way to help eliminate dust and dirt accumulation, improve system reliability and save many times the cost in reduced maintenance and downtime. What's more, your **satisfaction is 100% guaranteed**.

Cover Craft Dust Covers are available from your local computer retailer or contact Cover Craft.

Can you afford to wait any longer?



P.O. Box 555, Amherst, NH 03031
Telephone (603)889-6811

Circle 220 on inquiry card.

loader program can either abort the data transfer immediately, initiate a second read attempt from the last record, or display an error message on the computer terminal prompting direct operator intervention.

Theoretical Advances

As reviewed by Peterson and Weldon, the Hamming algorithm falls in the category of *cyclic codes*. (See reference 3.) In cyclic codes, executing a one-unit right-shift operation on any symbol in the complete code set will produce a binary bit pattern identical to that of one of the *other* members of the code set. Since Hamming's initial publication, an extensive array of cyclic codes has been derived. Perhaps the best known are the Bose-Chaudhuri-Hocquenghem (BCH) codes, which are related to the Hamming algorithm.

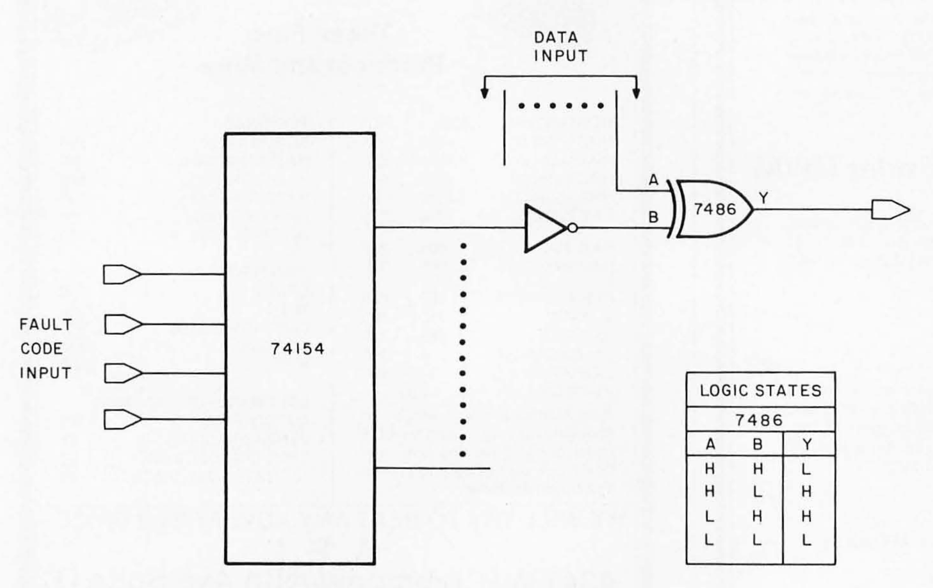


Figure 10: *Detail of the error-correcting logic. Error correction is achieved by loading a binary pointer into a 4-to-16 line demultiplexer that flags the proper bit line and corrects the fault with an exclusive-OR inversion. Eight-bit systems may load the fault code directly into the demultiplexer and avoid the use of a read-only memory.*

The BCH codes actually represent a generalized expansion that is particularly suited to coping with multiple-bit errors. None of these newer solutions offer major advantage over the basic Hamming check when correcting an 8-bit data word. Several mathematical difficulties are encountered when attempting to derive more effective encoding procedures. Not only is word length relatively short in these systems, but it can be shown that code redundancy overhead can be minimized to a tolerable level in only a small number of cases.

The alternative method, which is not unreasonable, would be to encode and decode entire data blocks, as opposed to individual data words. This would take advantage of the increased coding efficiency found for the longer codes, but would probably require a software implementation to minimize hardware design and expense. Such an approach would certainly increase system reliability, but it would defeat the purpose of increasing the speed and efficiency of data transfer to and from mass storage, since the processor would spend considerable time encoding and decoding the parity and data blocks before and after each data transfer. ■

References

1. Hamming, R W, "Error Detecting and Error Correcting Codes," *Bell System Technical Journal*, Volume 26 Number 2 pages 147 thru 160, American Telephone and Telegraph Company, 1950.
2. West, J T, "Product Development Profile: Data General Corporation," *Electronics* Volume 48 Number 23 pages 130 thru 136, November 13, 1975.
3. Peterson, W Wesley and E J Weldon Jr, *Error-Correcting Codes*, Second Edition, MIT Press, Cambridge 1972.
4. Sellers, F, Hsiao, M Bearnson, L, *Error Detecting Logic for Digital Computers*, IBM Corporation Systems Development Division, McGraw-Hill.

Circle 222 on inquiry card.

Circle 223 on inquiry card.

General Ledger
Payroll
Accounts Receivable & Payable

Flexible and sophisticated business software that is among the highest quality on the market. Originally developed by OSBORNE & ASSOCIATES and rapidly becoming a standard. Our service is support. We will send you these programs with the proper I/O and CRT specific subroutines for your hardware configuration. Get back to business and leave the programming to us. Include hardware description with order.

- Accounts Receivable and Payable 145.00
- Payroll (California) 145.00
- Non California state tax calculations (please inquire) 15–250.00
- General Ledger 145.00
- Multiple profit center option for G/L 25.00
- Manuals (each) 20.00

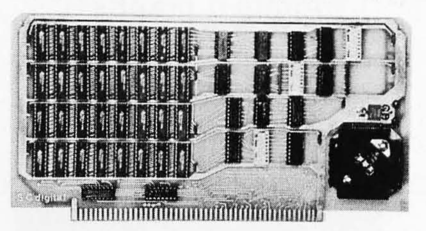
All programs in CBASIC under CP/M (includes source)

UTILITIES

- DOS MOVER for NORTH STAR. Moves DOS and BASIC anywhere you want it. (i.e., from 2A00 to 0000) 35.00
- ALS-8 MOVER on North Star Disk 35.00

Synergetic Computer Products
508 University Ave • Palo Alto, CA 94301
(415) 328-5391
Visa • Mastercharge • COD • Certified Check
CP/M is a trademark of Digital Research

S.C. Digital Proudly Introducing "UNISELECT" Model 16KUS



16K Static Memory (Ram) with Universal Bank Select

Introductory Price: $255
with 250 nsec memory chips
Assembled, Tested, and Guaranteed.

Featuring:
S-100 Compatible - Meets IEEE-S100 standard.
Fully Static - 4045 or 2114, No DMA restrictions.
Addressing - Dip switch addressing in 16K blocks.
Bank Select - Port and bits dip switch selectable. Compatible with Alph Micro, Cromemco, Marinchips, North Star, etc.
Phantom - Built in memory disable via Phantom line.
Quality - Fully socketed, silk legend, solder masks, gold contacts.
Orders - MC, Visa or COD ($4 handling charges for COD) or Personal check. Shipping from stocks to 2 weeks. Illinois residents add 5.25% sales tax.

S.C. Digital P.O. Box 906 Aurora, IL 60507 Phone: (312) 897-7749

Unlock the ENGINEERING POWER of the Microcomputer

Engineering Software for TRS-80 Mods I & II

- Air Cond. Com. Cooling/Heating Load
- Residential Cooling/Heating Load
- Hardy Cross Water Network Analysis
- Word Processing for Spec Writing
- Lighting Design
- Air Duct Design
- Accounting
- Surveying
- Solar F-Chart & Econ. Analysis
- Energy Invest. Econ. Anal. (June)
- Hydraulic Pipe Design
- Electrical Fault Current (June)
- Fire Sprinkler System Design
- Life Cycle Cost Analysis

Selected programs also available for other microcomputers

Please tell me more about your engineering programs.
Name ____________
Company ____________ Phone ____________
Address ____________
City ____________ State ______ Zip ______
I am interested in ____________

MC 2 ™ PROGRAMS formerly scot·ware
McClintock Corp.
P.O. Box 430980
Miami, FL 33143
(305) 666-1300

CATCH THE S-100 INC. BUS!

S-100

	LIST PRICE	OUR SPECIAL CASH PRICE
SSM CB-2 Z-80 CPU Kit	210.00	179.00
SSM VB-3 80x24 Video Boardkit	375.00	320.00
Dynabyte MCS 1625 16K Static RAM 250 NS A&T	555.00	349.00
Godbout Econoram VII A-24K 4MHz Memory "Unkit"	419.00	358.00
S.D. Systems Expandoram 64K Memory Board Kit w/o RAM	220.00	188.00
Shugart SA400 Double Density Bare Drive	450.00	295.00

Subject to Available Quantities • Prices Quoted Include Cash Discounts. Shipping & Insurance Extra.

We carry all major lines such as S.D. Systems, Cromemco, Ithaca Intersystems, North Star, Sanyo, ECT, TEI, Godbout, Thinker Toys, Hazeltine, IMC For a special cash price, telephone us.

Hours: Mon.-Fri. 10 A.M.-6 P.M.

Bus .... **S-100, inc.**
Address ..... **7 White Place Clark, N.J. 07066**
Interface **201-382-1318**

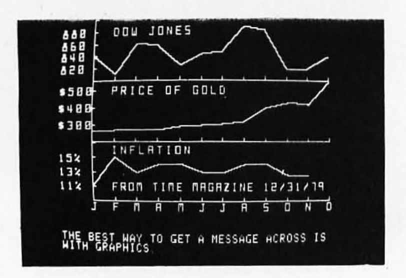
Circle 224 on inquiry card.

Circle 225 on inquiry card.

Circle 226 on inquiry card.

Use x,y Genesis

Applesoft Subroutines for Apple II graphs



With x,y Genesis you'll have:

- smaller programs
- shorter programming time
- subroutines useful in any program
- periodic news on tips & applications
- a professional product

At only $74.95

Contact:

FUTUREWORLD
Dept. B5
2514 University Dr.
Durham, NC 27707
(919) 489-7486

Ask about our new business statistics software.

Circle 227 on inquiry card.

VULCAN = DBMS

THE PROFESSIONAL and PERSONAL DATABASE MANAGEMENT SYSTEM

For 8080/Z80 systems under CP/M® *or PTDOS*

- * **VULCAN** is a complete database management system that has 38 powerful, easy to learn, English-like commands to manipulate files, records, fields, and scratch-pad variables.
- * **VULCAN** has a command repertoire which includes such commands as: SORT, REPORT, APPEND, INSERT, EDIT, COPY, REPLACE, LOCATE, DISPLAY, DO, LIST, and LOOP.
- * **VULCAN JR.** is an interactive inquiry/response system while VULCAN can be used in interactive or program mode. The program mode uses modern structured command programs to combine powerful DBMS operations.
- * **VULCAN** is written in assembly language for efficient information processing and requires 36K bytes CP/M® system and one or more disk drives.
- * **VULCAN** can accept or store data in standard ASCII files to be compatible with BASIC, FORTRAN, word processors, etc.
- * **VULCAN** can be used for mail lists, inventory, accounting systems, parts lists, etc. It puts you in fingertip control of your data. With VULCAN, you don't need to write a program to do something out of the ordinary.

***VULCAN** (CP/M® or PTDOS)	$490
***VULCAN JR.** (CP/M® only)	$ 98
Manual only	$ 25

SCDP

Software Consultation Design and Production
6542 Greeley St.
Tujunga, CA 91042 (213) 352-7701

California residents add 6% sales tax.

CP/M® is a registered trademark of Digital Research

DATADISK SYSTEMS

PROFESSIONAL SOFTWARE FOR NORTH STAR SYSTEMS

DIGITAL RESEARCH

CP/M*2.0 — Digital Research's latest disk operating system for 8080/8085/Z80 based microcomputers, now specially tailored for the North Star disk systems. Includes ED text editor, DDT debugger, ASM assembler, additional utility programs and complete documentation. CP/M 2.0 is upward compatible with earlier releases and makes a wealth of professional software available to your system. .... **†$150/$25**

TEX - A powerful text formatter. Produces finished copy with automatic page numbering, left and right margin justification, indentation, page headers, line centering and other quality features. Output may be vectored to printer, disk or console......... **$70/$15**

MAC — 8080 Macro assembler. Allows use of library programs, greatly increasing programming efficiency. Uses Intel macro conventions. Assembly toggles allow listing, hex and symbol table outputs to be directed to disk, printer, console or combination. A tremendous development aid. .... **$85/$15**

SID — Symbolic Instruction Debugger for the 8080. Allows multiple break points with user set pass counter. Displays user labels during debugging when used with MAC. Greatly reduces hard-copy listing requirements. Includes back-trace and histogram utilities. A must for serious software development. .... **$85/$15**

ZSID — Same as SID except incorporates complete Z80 instruction set and uses Z-80 mnemonics. .... **$95/$15**

DESPOOL — Allows simultaneous printing of disk files and user access to other programs. No need to stop production while lengthy printouts are in progress. .... **$45/$5**

SOFTWARE SYSTEMS

CBASIC-2 — A commercially oriented, compiler-interpreter extended disk BASIC. Self documenting, using full length variable labels without penalizing speed. Compiler permits distribution of software without releasing source code. .... **$105/$15**

California residents add 6% sales tax.
Specify single, double or quad capacity.
Additional formats available soon.
Structured Systems Group programs require CP/M and CBASIC-2.
*CP/M is a registered trademark of Digital Research.
†Software and documentation/documentation only.

BUSINESS SOFTWARE FROM STRUCTURED SYSTEMS GROUP

GENERAL LEDGER — A comprehensive applications package for business accounting or CPA multi-client write up. Produces financial reports to user defined specifications. Interactive posting, balance sheet, income statement, general and cash disbursement journals, sort, multiple profit centers, accounts distribution and much more. Outstanding package. .... **$895/$25**

ACCOUNTS RECEIVABLE — A complete open item or balance forward system. Operates alone, or interfaces with General Ledger. Produces customer statements, aged trial balance, on-line inquiry, sales reports, reminder notices and more. ...... **$695/$25**

ACCOUNTS PAYABLE — A powerful cash management system. Aged account statements, writes checks, cash requirements projection, General Ledger update and more included. Stand alone operation or interfaces with General Ledger and QSORT.................................. **$695/$25**

NAD — Name and Address System - Stores mailing lists on disk. Prints mailing labels or lists additional references information. Selective data extraction. .... **$75/$10**

QSORT — A generalized, full disk sort/merge package. Fast and flexible. Multiple key sorting. .... **$95/$15**

LETTERIGHT — Word processing for the business office. Produces professional correspondence, letters, envelopes, and more. High speed production with minimal training. Multiple personalized letters produced when used with list formed by NAD. .... **$175/$20**

ANALYST — Generalized data base management program. Stores and retrieves disk data producing user formatted reports. Interactive input. Easy to use. Tremendous versatility. .... **$225/$20**

INVENTORY — Complete inventory control program limited in capacity only by your disk size. On-line inquiry, average valuation, reorder and activity reports with report range option. Menu driven and fully auditable, the system uses full screen formatting and permits user defined record numbers. .... **$795/$25**

NOW—AN AFFORDABLE HARD DISK

Ask about our 13.2 megabyte Winchester technology hard disk business system. Uses all above listed software. Price varies with software configuration.



Datadisk Systems, P.O. Box 195, Poway, CA 92064, (714) 578-3831

6809!

INTRODUCING THE NEW STATE-OF-THE-ART IN MICROCOMPUTER SOFTWARE.

Call or write today for our free catalog.

MICROWARE

5835 Grand Ave. • P.O. Box 4865
Des Moines, IA 50304 • 515/279-8844

Circle 228 on inquiry card.

Circle 229 on inquiry card.

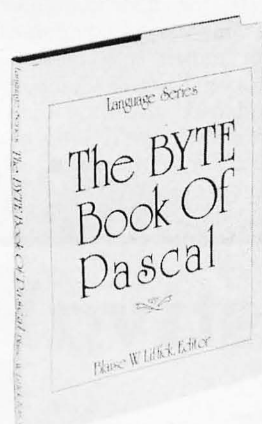
Take the mystery out of programming

with the latest from BYTE Books™

The BYTE Book of Pascal

Edited by Blaise W. Liffick

Based on the growing popularity of Pascal as a programming language, numerous articles, language forums and letters from past issues of BYTE magazine have been compiled to provide this general introduction to Pascal. In addition, this book contains several important pieces of software including two versions of a Pascal compiler - one written in BASIC and the other in 8080 assembly language; a p-code interpreter written in both Pascal and 8080 assembly languages; a chess playing program; and an APL interpreter written in Pascal.



$25.00 Hardcover pp. 342
ISBN 0-07-037823-1

YOU JUST BOUGHT A PERSONAL WHAT?



by Thomas Dwyer and Margot Critchfield

Whether you are a novice programmer or an experienced computer user, this book is filled with practical ideas for using a personal computer at home or work. It will take you through the steps necessary to write your own computer programs, and then show you how to use structured design techniques to tackle a variety of larger projects. The book contains over 60 ready-to-use programs written in Microsoft and Level II BASIC in the areas of educational games, financial record keeping, business transactions, disk-based data file and word processing. **$11.95 pp. 256 ISBN 0-07-018492-5**

Beginners Guide for the UCSD Pascal System

by Kenneth Bowles

Written by the originator of the UCSD Pascal System, this highly informative book is designed as an orientation guide for learning to use the UCSD Pascal System. For the novice, this book steps through the System bringing the user to a sophisticated level of expertise. Once familiar with the System, you will find the guide an invaluable reference tool for creating advanced applications. This book features tutorial examples of programming tasks in the form of self-study quiz programs. The UCSD Pascal Software Systems, available from SofTech Microsystems Inc, 9494 Black Mountain Road, San Diego CA 92126, is a complete general purpose software package for users of microcomputers and minicomputers. The package offers several interesting features including:

- Programs which may be run without alteration on the General Automation or DEC PDP-11 minicomputers, or an an 8080, 8085, Z80, 6502, 6800, or 9900 based microcomputers.
- Ease of use on a small, single-user computer with display screen and one or more floppy disk drives.

$11.95 ISBN 0-07-006745-7

These and other BYTE/McGraw-Hill books are available from BYTE Books or your local computer store.

Please send

☐ ________ copies of **The BYTE Book of Pascal**
☐ ________ copies of **You Just Bought a Personal What?**
☐ ________ copies of **Beginner's Guide for the UCSD Pascal System**

Add 75¢ per book to cover postage and handling.

Name ____ Title ____ Company ____

Street ____ City ____ State/Province ____ Code ____

☐ Check enclosed in the amount of $________
☐ Bill Visa ☐ Bill Master Charge
Card No.________ Exp. Date.________

BYTE BOOKS

BYTE BOOKS Division • 70 Main Street
Peterborough, NH 03458 B5

The NCC:
New Emphasis on Personal Computing

What's happening in personal computing? The American Federation of Information Processing Societies, Inc (AFIPS) is banking that you'll find out at the National Computer Conference's Personal Computing Festival, to be held on May 20-22 in Anaheim, California at the Anaheim Convention Center. In the 3 years that personal computing has had a separate exhibit area at the NCC, the number of exhibitors has increased from 76 to 154. Over 20% of those who came to the NCC last year registered specifically for the Personal Computing Festival, and over half of the 60,000 plus attendees visited the Festival.

The booming show-attendance figures reflect the fast growth of the personal-computing industry as a whole. Highlights include the Apple Computer Company's expectations to triple its sales by the end of 1980. Commodore International computer sales may increase by a factor of 2 during the first quarter of 1980, and Radio Shack expects similar increases. According to industry estimates, the market value of personal-computer software sold in 1980 could surpass $150 million.

Judging from the attendance at last March's West Coast Computer Faire in San Francisco (approximately 20,000), there is an ever-increasing interest in personal computing among a wide variety of people. We expect to see a trend toward more sophisticated software at the 1980 NCC Personal Computing Festival. There will be a flood of new Pascal packages, new simulation programs, the appearance of new Forth software (look for the special section on the Forth language in the August 1980 BYTE), as well as intriguing new hardware like Microsoft's new Z80 processor circuit card for the Apple computer that allows Apple owners to use programs written to run under Digital Research Corporation's CP/M operating system. Word-processing and small-business software are two other rapidly growing areas that will be well represented at the conference.

Will some major consumer electronics companies enter the personal computer market? Is there a move toward some standardization in the microcomputer industry? Will Japanese companies make any major moves into personal computing? [Nippon Electric Company (NEC) is rumored to be unveiling a new computer at the show]. We'll keep our eyes open at the show to find out! ■

Personal Computing Festival
Preliminary List of Exhibitors

ABC Computer Inc
American Word Processing Co
Apple Computer Co
Applied Digital Data Systems Inc
Artec Electronics Inc
Atari

BASF Systems
Benwill Publishing Corp
BYTE Publications Inc

California Computer Systems
Cardamation Co
Centronics
Comprint
Compucolor Corp
Compucorp
Computer City
Computer Textile
Computerworld
Computhink
Control Data Corp
Corvus Systems Inc
Creative Computing
Cromemco Inc

Diablo Systems Inc
Dilithium Press

Electronic Data Systems-Evolution I
Executive Information Systems Inc
Exidy Inc

Findex Inc

Harris Technology
Hayden Book Co Inc
H & E Computronics
Heath/Zenith
Hewlett-Packard Co

Industrial Micro Systems
International Memories Inc (IMI)

Jade Computer Products

Leedex Corp
Lobo Drives International
LRC/An Eaton Co

3M-Data Recording Products Div
MAS (Micro Application Systems Inc)
Memory Media Products
MicroAge
Microamerica Distributing Co Inc
Microcomputer Technology Inc
Micromail
MicroPro International Corp
Microsette Co
Microsoft

NEC America Inc
North Star Computers Inc

Omni Magazine
Osborne/McGraw-Hill

Personal Software
Priam
Prodigy Systems Inc

RCA MicroComputer Products
Radio Shack
Realizations Etudes Electroniques (R2E)
Rockwell Microelectronic Devices

SD Systems Inc
Sharp Electronics Corp
Smoke Signal Broadcasting
Spectra Logic Corp
Sybex Inc

TEI Inc
TSA Software

Xymec

Personal Computing Festival Program Schedule

May 20 — Tuesday — 10:00 AM
High-Level Languages
Pascal Part I
Jim Gagne

Word Processing
Shopping by Objectives
Bill Radding

Portable Personal Computing
Jim Flournoy

1:00 PM
Higher-Level Languages
Pascal Part II
Jim Gagne

Computer Hardware Considerations & Applications
L Silvern

Forth Business Applications
Jim Flournoy

2:30 PM
Networks You Can Access With Your Personal Computer
Cliff Barney

May 21 — Wednesday — 10:00 AM
Using Computers to Overcome Disability Handicaps
Part I
Jeff Moyer
Mary Anne Glicksman

The Future of Personal Computing
Panel
Verne Kallejian

Operating Systems
Roger Vass

1:00 PM
Using Computers to Overcome Disability Handicaps
Part II

Computer Networks-Technical
Craig Vaughn

Software Evaluation
Tom Williams

2:30 PM
Computer Music
Carl Helmers

May 22 — Thursday — 10:00 AM
Medical Computing for Microprocessors
Jim Gagne

Data Base Management
Doug Seeley

Computers In Education
Chris Morgan

1:00 PM
Use of Computers in Kindergarden thru Ninth Grade
Flora Russ

Business Applications
Nancy Leeper

Computers In Education Panel
Chris Morgan

2:30 PM
Programming Potpourri

1980 NCC List of Exhibitors

Able Computer
Addison-Wesley Pub Co Inc
Advanced Systems Inc
AFIPS Press
Aham Inc/Rubber Urethane
Alanthus Data Communications Corp
Alpha Data Inc
Alpha Micro
AM International
Amco Engineering Co
American Magnetics Corp
American Terminal Leasing
Ampex Corp
Anadex Inc
Anderson Jacobson Inc
Ann Arbor Terminals Inc
Applied Digital Data Systems Inc
Applied Magnetics Corp
Aspen Ribbons
Association for Computing Machinery
Atlas Energy Systems
Audiotronics Video Display Div
Auerbach Publishers Inc
Aydin Controls

Ball Corp
BASF Systems
Basic Four Corp

Battelle Memorial Institute
BDT Buro-und Datenztchnik Gabil
Beehive International
Bell & Howell Display Devices
Bell System
Benson-Varian Int
Benwill Publishing Corp
Berger-Lahr Corp
Boschert Inc
British Trade Development Office
BTI Computer Systems
Burroughs Corp

CalComp
Caracters USA Inc
Centigram Corp
Centronics
Century Data Systems—A Xerox Co
Chromatics Inc
Cii Honeywell Bull
Cipher Data Products Inc
Circuit Assembly Corp
Clinton Electronics Corp
CMP Publications
Codex Corp
Compugraphic
Computer Automation
Computer Decisions
Div of Hayden Pub Co Inc
Computer Design
Computer Devices
Computer-Link Corp
Computer Power Systems
Computer Products Magazine
Computer Roomers Inc
Computer Science Press Inc
Computer Transceiver Systems Inc
Computerworld Computer Business News (CW Communications)
Computron Technologies Corp
Contal Corp
Conrac
Continental Resources
Control Data Corp
Cortron & Licon Div IIW
Cullinane Corp
Curtis 1000 Inc
Custom Systems Inc
Cyberex Inc

Daily Business Products
Data Access Systems Inc
Data Communications/McGraw-Hill Publications
Data Dimensions Inc
Data Electronics Inc
Data General Corp
Datagraphic
Data-Mate/Maine Manufacturing Co
Datamation
Datamedia Corp
Data Motion
Data Printer Corp
Datapro Research Corp
Data Processing Management Assoc
Data Processing Power
Dataran Corp
Data Specialities Inc
Dataware Inc
Datum Inc

Deciteck
Delta Data Systems Corp
Deltec Corp
Diablo Systems Inc
Digi-Data Cor.
Digi-Log Systems
Digital Associates Corp
Digital Computer Controls
Digital Equipment Corp
Digitech Data Industries Inc
Digitronics Div Contec Information Systems
Distributed Logic Corp
Diva Inc
Documation Inc
DOSC Inc (Digitron)
Dranetz Engineering Labs Inc

Eastman Kodak Inc
Edge Technology Inc
Educational Data Systems
Eichner Systems Inc
Electronic Component News
Electronic News
Elgar Corp
Emergency Power Engineering Inc
Emerson Electric Co
Emulex Corp
Epic Data
Epicon Inc
Epson America Inc
Exide Power Conversion ESE Inc

Facit Inc
Fairchild Camera & Instrument
Floating Point Systems Inc
Florida Data Corp
Four-Phase Systems
Fujitsu Ltd

General Automation Inc
General DataCom Industries Inc
General Electric Co
General Robotics Corp
General Terminal Corp
GMT Automatic Inc
Graphic Controls
GTE Sylvania

Hamilton Avnet
Harris
Haveg Industries Inc
Hazeltine Corp
HEI Inc
Hitachi America Ltd
Honeywell Information Systems Inc
Houston Instruments
Hutchinson Industrial Corp

IBM Corp
ICI American Inc
IEEE Computer Society (Computer Magazine)
Incoters Corp
Industrial Engraving Co Inc
Information Processing Inc
Informer Inc
Infosystems Magazine/Hitchcock Pub Co
INMAC

Innovative Electronics Inc
Input
Integral Data Systems
Integrated Software Systems Corp (ISSCO)
Intelligent Systems Corp
Interdyne Co
Interface Mechanisms Inc (Intermec)
International Data Corp
International Mathematical & Statistical Libraries Inc (IMSL)
International Power Machines Corp
Interstate Electronics Corp
Intertec Data Systems Corp
C Itoh Electronics Inc

Japan Market Consultants Div Engineers International Inc

Kennedy Co
Key Tronic Corp
Knickerbocker Case
Kybe Corp

Liebert Corp
LogAbax SA—US Div

3M
Magnavox Display Systems
Mag-Tek Inc
Management Science America
Mathematics Products Group Inc
Maxell
McCormack & Dodge Corp
McGraw-Hill Book Co
MDB Systems Inc
Megatek Corp
Melco Sales Inc
Memorex Corp
MFE Corp
Micon Systems Inc
Micon Industries
Microcomputer Systems Corp
Microdata Corp
Micro Peripherals Inc
Micropolis Corp
Micro-Term Inc
MiniComputer Systems Inc
Mini-Micro Systems Cahmers Pub
Monolithic Systems Corp
Mostek Corp
Motorola Inc
MBI Systems Corp

Nanodata Corp
National Computer Communications Corp
National CSS
National Electric Cable
National Technical Information Service
NCR Corp
NEC Information Systems Inc
Network Systems Corp
Newman Computer Exchange Inc
Nicolet Zeta Corp
Nippon Peripherals Ltd
Nixdorf Computer Corp
Northern Zelecon Systems Corp
Nortronics Co Inc
Nova Electric Manufacturing Co

Ohio Scientific Inc
Okidata Corp
Ontel Corp

Panasonic Co
Paradyne Corp
Peripheral Dynamics Inc
Perkin-Elmer
PerSci Inc
Pertec Computer Corp
Philips Test & Measuring Instruments Inc
Plessey Peripheral Systems
PolyMorphic Systems
Practical Automation
Precision Handling Devices
Prentice Corp
Prentice-Hall Inc
Prime Computer Inc
Princeton Electronic Products
Printronix Inc
Pro-Log Corp

Qantel Corp
Qantex
Quantor
Qume

Rascal-Milgo Inc
Racal-Vadic
Radio Shack
Ramtel Corp
Randomex Inc

Raymond Engineering Inc
Remex Div/Ex-Cell-O
Resource Management—Div of Cutler Williams
Ranco Electronic Systems

SAS Institute Inc
Scientific Measurement Systems Inc
SCI Systems Inc
Sheldon Industries Inc
Shugart Associates
Society for Computer Simulation
Software AC
Sola—A Unit of General Signal
Spatial Data Systems Inc
Specialized Products Co
Sperry Univac
Storage Technology
Structured Methods Inc
Summagraphics Corp
Systems Furniture Co

TAS Products Co
Tally Corp
Tandberg Data Inc
Tandem Computers Inc
T-Bar Inc
TEAC Corporation of America
Technology Transfer Institute
Techtran Industries Inc
Tektronix Inc
Teledyne Instruments

Telefile Computer Products Inc
Telenet Communications Corp
Teletype Corp
Televideo Inc
Telex Computer Products
Terak Corp
Termiflex Corp
Tesdata Systems Corp
Texas Instruments
Timeplex Inc
Tokyo Juki Industrial Co Ltd
Topax Electronics
Toshiba International Corp
Trilog Inc
Triple I Inc
Tymnet Inc

Universal Data Systems

Van Nostrand Reinhold
Van San Corp
Vector Graphic Inc
Verbatim Corp
Versatec
Victor Data Products
Vistron Corp
Vu-Data Corp

Wabash Tape Corp
Wall Street Journal
Wang Labs Inc
Warrex Computer Corp
Wavetek Data Communications
Wescorp
Western Peripherals
Westrex OEM Products
John Wiley & Sons Inc
Wintek Corp

Xerox Business Systems

Yourdon Inc

Zenith Radio Corp
Zilog Inc

NCC Main Conference Proceedings

During each of the 4 days of the NCC, there will be discussions and papers related to the following major topics. A detailed schedule of events will be available at the conference.

Computer Architecture
Covers design of equipment and supporting technologies, and distribution through networking. Includes decisions relating to supersystems, survivability systems and data-base installation.

Applications of Computer Technologies
Explores the use of computers in entertainment, microcomputers and their impact, management of the computing tool and staff, and the role of inhouse and academic education and training.

Data Base Management & Communications
State-of-the-art, user-oriented sessions on the storage, retrieval, and transfer of data. From hardware considerations to natural-language access to a data base.

Office Automation
Every computer-related aspect of this explosive growth area, including electronic mail. How computers are used, managed, and integrated in an overall automated office.

Simulation Technologies
Where we've been, where we are, and where we're going with computer modeling. Its value to small and large businesses and its role in decision support will be discussed. Special sessions on solar energy-simulation modeling will be included.

Software Engineering Technologies
Sessions on programming standards, software quality assurance, languages, and requirements engineering. Emphasis upon the needs and responsibilities of the user.

Social Dynamics and Special Topics
A broad spectrum of critical subjects: data security, legal issues, transborder data flow, societal impact, voice communications, venture capital and its effect upon technology.

Image Processing and Computers in Medicine
How image processing is used and will be used in industry and medicine. Trends in facsimile data coding, compression, and standards. How doctors use image-analysis display.

Professional Development Seminars
Full and half-day seminars for the professional who wants to come away with solutions and ideas he can implement now. Half-day seminars tie in with regular program sessions.



RS-232C-Compatible Paper-Tape Reader

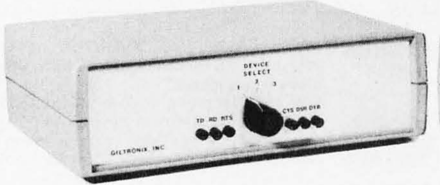
The Model 612 stand-alone paper-tape reader has the ability to read five- to eight-level tape and to transmit seven to eleven frames per character at 50 to 9600 bits per second (bps). It also features starting and stopping on character at all speeds, manual control or automatic on and off, 90 to 260 VAC, 50 to 60 Hz, and even, odd, or no parity. RS-232C, current loop, or parallel outputs are available. The price of the 612 is $656 to $854. Contact Addmaster Corp, 416 Junipero Serra Dr, San Gabriel CA 91776.

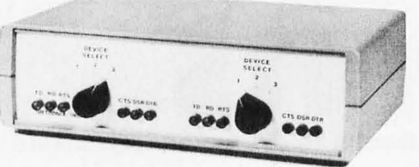
Circle 562 on inquiry card.

Bidirectional Interface for the PET

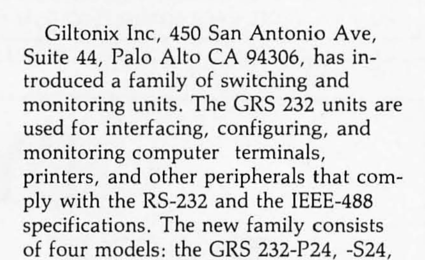
This interface package is a combination of hardware and software that enables any model of the Commodore PET to send and receive data on printers, terminals, and other peripherals. ASCII/ISO-7 characters are sent from the PET in serial or parallel mode but are received in serial mode only. Serial speeds are selectable at rates up to 240 characters per second (cps). The interface is available for either 20 mA current loop or transistor-transistor logic (TTL) serial or parallel. The machine-language program may be stored anywhere in programmable memory; the code used to terminate a message is selectable. The price for the package is £70 (approximately $160). Further details from Allen Computers, 16 Hainton Ave, Grimsby, South Humberside, ENGLAND.

Circle 563 on inquiry card.





Centronics-Compatible Switching and Monitoring Units



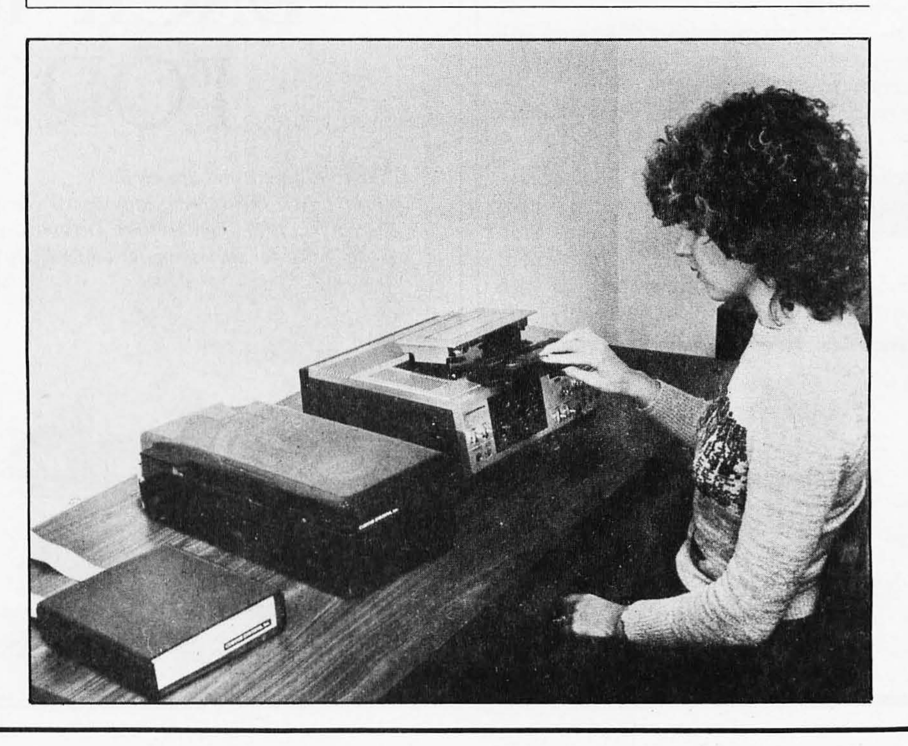
Giltonix Inc, 450 San Antonio Ave, Suite 44, Palo Alto CA 94306, has introduced a family of switching and monitoring units. The GRS 232 units are used for interfacing, configuring, and monitoring computer terminals, printers, and other peripherals that comply with the RS-232 and the IEEE-488 specifications. The new family consists of four models: the GRS 232-P24, -S24, -2P24, and -2S24. Each unit consists of a standard three-way switching system and an optional interface monitor. All the units can be cascaded and thereby allow interfacing of more than five devices. The systems can be ordered with signal monitoring capability. The units are priced at approximately $130.

Circle 564 on inquiry card.

Large Capacity Winchester Backup from Corvus

This backup system, the Mirror, employs a standard video cassette with a total capacity of 100 megabytes. In less than ten minutes, the 10 megabytes of data on the Corvus 8-inch hard disk can be transferred to a Mirror cassette. The video cassette should be of the VHS, Beta, or U-Matic format. If a larger data capacity is required, a reel-to-reel videotape recorder can be used. This approach to storage embodies standard television technology and proven cassette reliability. The Mirror uses the same Z80 and Corvus interface bus as the Corvus disk. The Mirror will interface to the Apple II, TRS-80, S-100, and LSI-11 computers. Data format in the Mirror is fully compatible with the standard NTSC signal. For error detection, the Mirror contains cyclic redundancy check (CRC) detection hardware. If unattended or remote operation is desired, a low-cost option is available to interface the Mirror to the Panasonic Omnivision NV-8200 cassette recorder allowing archival storage files to be created without operator interaction. The price of the Mirror is $790. Write Corvus Systems, 900 S Winchester Blvd, San Jose CA 95128.

Circle 565 on inquiry card.



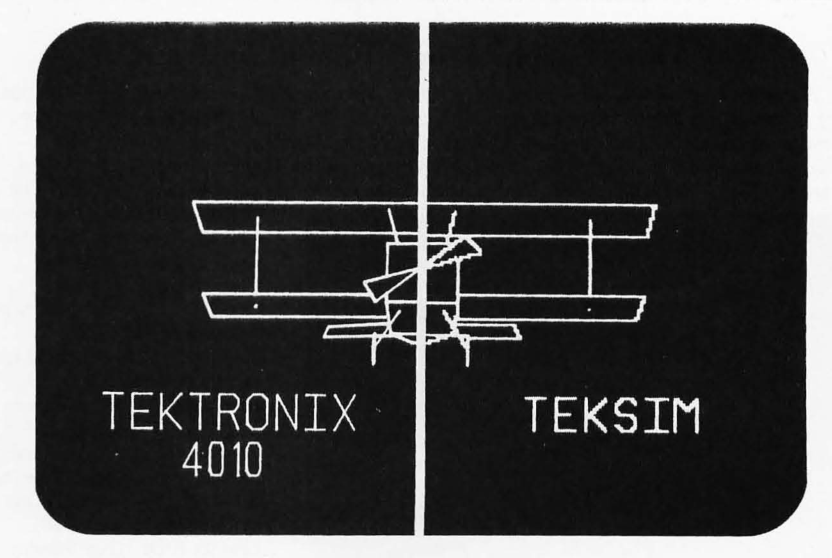
What's New?

MISCELLANEOUS

Speechlink Voice Recognition for S-100 Computers

Heuristics has announced its Model 20S-64 Speechlink 64-word voice input unit for S-100 bus computers. The 20S-64 is a speaker-programmed, isolated word-recognition device that recognizes up to 64 words at each instant. Vocabulary sets may be stored away and recalled when needed. This system will produce a usable vocabulary of several hundred words for data entry and system control applications. Word recognition is completed in 200 ms. Successive words must be separated by at least 100 ms of silence. Preprogramming of the Speechlink is necessary. The unit requires 2 K bytes of programmable memory for programs, and 64 bytes for each word in the vocabulary, up to a maximum of 4 K bytes. The price is $299 including board, microphone, and manual. Contact Heuristics Inc, 1285 Hammerwood Ave, Sunnyvale CA 94086.

Circle 441 on inquiry card.



Graphics Terminal Emulator for Apple IIs

TEKSIM, the Tektronix Simulator, employs distributed processing in its programming approach and uses the Apple's high-resolution plotting capabilities to emulate Tektronix 4010-series graphics terminals. No modification to the program in the remote computer is required to display or input graphic data. The TEKSIM-Apple combination features multicolored displays, selective erase, and a standard video output that lets any television set used with an RF converter function as a monitor. The suggested price for the plug-in device is $795, and it is available from ABW Corp, POB M 1047, Ann Arbor MI 48106.

Circle 442 on inquiry card.

Hardware and Software for Homebrewers

Snow Micro Systems Inc, POB 1704, Silver Spring MD 20902, provides low-cost hardware and software to personal computer users and clubs. Their bare boards are sold with schematics, layout drawings, and component lists. They are unassembled and come without parts. The company offers a troubleshooting service, if necessary. Some of their products include a front panel interface card, the Golem-80 S-100 Troubleshooter, a Station Controller Card, and more. Snow Micro software includes AMS-80 Version 5.8 debug packages, object code and source code, and other AMS-80 software related items. For prices and information, contact Snow Micro Systems at the above address.

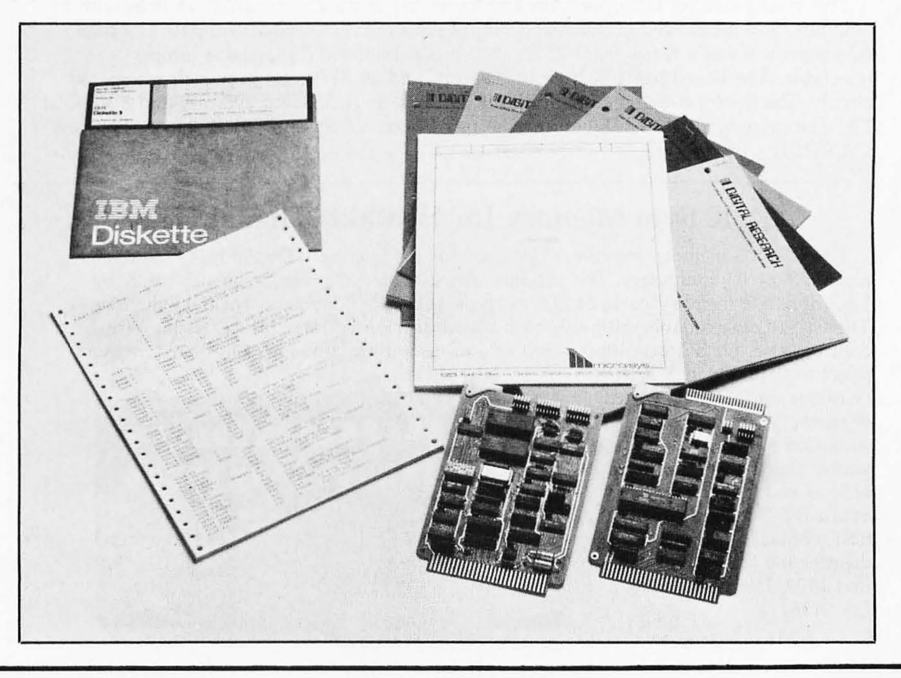
Circle 443 on inquiry card.

CP/M Package for the STD Bus

Micro/sys has developed a CP/M system for the STD Bus microcomputer card system. The Micro/sys package consists of two STD Bus-compatible cards, the SB8500 Floppy Disk Controller, the SB8420 Dual Serial Interface, and an eight-inch floppy disk containing the CP/M system. The SB8500 can control up to four floppy disk drives from a single STD Bus slot. The SB8420 provides communication with a console device, and a second serial port that can be used for printers and other devices. The cards are compatible with 8085 and Z80 microprocessors.

CP/M provides a disk file management, a text editor, and an 8080 assembler, a dynamic debugger, and various utilities. Price of the Micro/sys CP/M package is $695. For more information, contact Micro/sys Inc, 1353 Foothill Blvd, La Canada CA 91011.

Circle 444 on inquiry card.

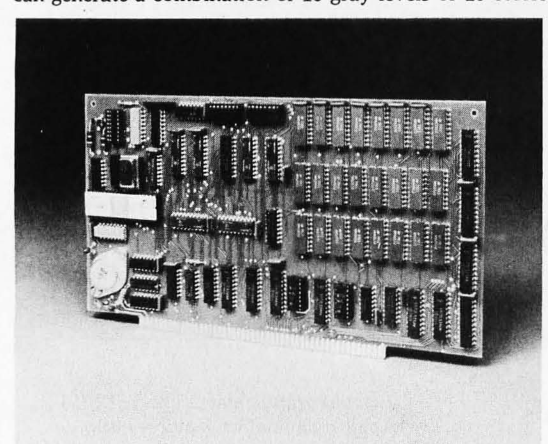


What's New?

MISCELLANEOUS

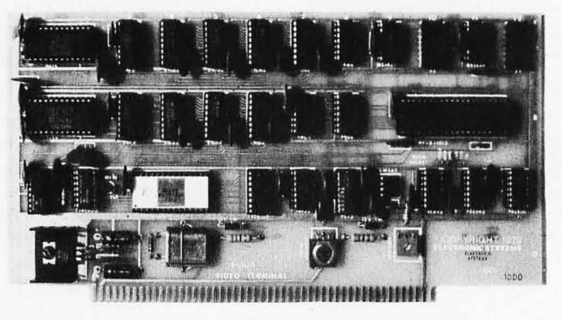
Video Graphics for S-100 Bus Systems

A single-card, high-density, computer-display system is being offered for the S-100 bus by International Product Development Incorporated (IPDI). The VG100 is designed for text-oriented applications. It has programmable fonts allowing any set of up to 256 characters to be defined in programmable memory with available software. The system can generate a combination of 16 gray levels or 16 colors, or combinations of both. The character field is 9 by 16 (or 144) pixels with a raster scan of 621 pixels. The entire character field can be changed at one time for fast animation. Adjoining character fields of any shape can be combined to create large continuous characters. The VG100 is configured in 12 K bytes of programmable memory and is selectable in three 4 K-byte blocks. The price is $645. For details, contact IPDI, 1708 Stierlin Rd, Mountain View CA 94043.



Circle 589 on inquiry card.

Video Terminal Board

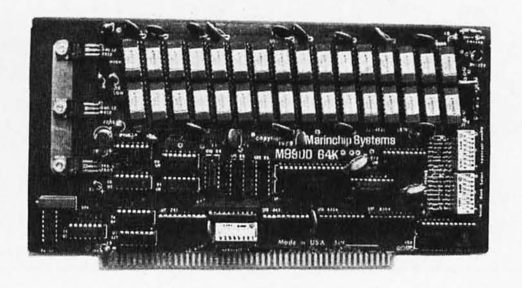


This board features full uppercase and lowercase, 5 by 7 dot matrix, 16 lines with 64 columns, and serial RS-232 input and output with parallel keyboard input. The data rate generator has a range from 75 to 1200 bits per second (bps) and is jumper-selectable. The board has 1 K byte of memory and an SFF96364 processor integrated circuit. The device is S-100 compatible. It requires ± 16 VDC at 100 mA and 8 VDC at 1A. The price is $199.95 in kit form. Contact Electronic Systems, POB 21638, San Jose CA 95151.

Circle 590 on inquiry card.

64 K Byte Memory for Heathkit/Digital H11

The CI-1103 memory module is designed for the Heathkit/Digital H11, LSI 11/2, and PDP 11/03 computers. The product uses 200 ns cycle time, type-4027, 4 K by 1-bit dynamic memory parts or 200 ns, type-4116, 16 K dynamic memory devices. The CI-1103 is available with either on-board distributed refresh or external refresh control logic. Data access time is 300 ns and cycle time is 525 ns. On-board memory-select is available in 2 K increments up to 128 K words of memory. Power consumption is under seven watts. The 8 K by 16 board is $390 and the 32 K by 16 board is $750. For information, contact Chrislin Industries Inc, 31352 Via Colinas #102, Westlake Village CA 91361.



Circle 591 on inquiry card.

Serial Interface Card for Apple II Computers

California Computer Systems' 7710A Asynchronous Serial Interface card enables the Apple II to communicate with all RS-232C serial devices. It is fully compatible with Apple Pascal. The card features selectable data rates from 50 to 19,200 bits per second (bps), 8- or 9-bit character transmission, and optional odd, even, or no parity. Software programmable interrupts, double buffered data input/output (I/O), and full handshaking are included. It is available in kit form or fully assembled and tested. The price for the card is $159.95. For more information, contact California Computer Systems, 250 Caribbean, Sunnyvale CA 94086.

Circle 592 on inquiry card.

Percom Board Interfaces Speak & Spell to Computer

Percom Data Co, 211 N Kirby, Garland TX 75042, has announced production of a printed circuit board which will interface the Texas Instruments Speak & Spell learning aid to a computer. The "Speak 2 Me 2" allows communication with a Speak & Spell in BASIC, so a computer can talk using the words and phrases of a Speak & Spell unit. The board is installed in the battery compartment. Installation involves disassembly and some modification of the Speak & Spell unit. The board with instructions, TRS-80 driver software, and a TRS-80 cable sells for $69.95. The cable connects to the printer port and may be adapted for other computers.

Circle 593 on inquiry card.

Head-Cleaning Floppy Disks from Lifeboat

Lifeboat Associates, 2248 Broadway, New York NY 10024, has an important product for floppy-disk systems: head cleaning disks. The head-cleaning floppy disks are manufactured by attaching a lint-free nylon mat to a mylar substrate. The design avoids damaging abrasion, which keeps head wear to within industry standards for normal magnetic media. The disk is used by inserting it into the drive in the same manner as a floppy disk, and loading the head for 30 seconds. It is recommended that this procedure be used once per day as prevention against oxide build-up. The disks are available in 5¼- and 8-inch sizes for $20 each, or $45 for three. Each disk is suitable for three months of daily use.

Circle 594 on inquiry card.

What's New?

PUBLICATIONS

Hardside Announces Expanded New Catalog

Hardside, a mail-order hardware company in Milford, New Hampshire, has announced the release of an expanded version of the Hardside catalog. Hardside features Radio Shack computer products at a discount price and also peripherals from other manufacturers which are suited to work with the TRS-80. The company specializes in computers and related hardware. The Hardside catalog is free from Hardside, 6 South St, Milford NH 03055.

Circle 572 on inquiry card.

Monthly Newsletter Covers the Office Computing Industry

Entitled the *Office Computing Industry Report* (OCIR), this monthly newsletter focuses on small-scale data processing, word processing, and data communications systems. OCIR also covers the merging of EDP and Business Machine distribution systems and support activities and the relationship of these new office computing systems to network-based information systems and distributed data processing. News analysis, market forecasts, new product reviews, vendor profiles, and technology forecasts are included. The *Office Computing Industry Report* is available from Vantage Research Inc, 2680 E Bayshore Rd, Mountain View CA 94043, for $195 per year in North America and $225 in Europe and Asia.

Circle 566 on inquiry card.

Supplies Catalog from Diablo

A 25-page brochure from Diablo Systems Inc, 24500 Industrial Blvd, Hayward CA 94545, illustrates and describes the variety of print wheels and ribbon cartridges designed for use on the company's Series 1640 and 1650, HyType, HyTerm, and matrix printers and terminals. The brochure contains a sample type line from all of the plastic and metallized daisy-wheel print elements. For copies of the brochure and the name of the nearest Diablo dealer, call (800) 227-2076, except in California where the number is (415) 443-2273.

Circle 567 on inquiry card.

S-100 Magazine Being Published



S-100 Microsystems is a new publication directed towards users of S-100 microcomputer systems. It is a forum on such S-100 topics as interfacing, CP/M, Pascal, Assembler, FORTRAN, and BASIC software. The magazine will also cover 16-bit microprocessors, multiprocessors, multitasking, timesharing, word processing, system development, data base management, scientific, and other applications and issues. It will be concerned with S-100 systems such as Cromemco, North Star, Intersystems, IMSAI, Poly Morphics, Processor Technology (Sol), Xitan, and others.

S-100 Microsystems is edited by Sol Libes. Sol has written 13 books, many magazine articles, and has edited several newsletters. He is the founder and past president of the Amateur Computer Group of New Jersey, the largest personal computer organization in the world. The first issue of *S-100 Microsystems* includes the complete proposed Institute of Electrical and Electronics Engineers (IEEE) S-100 Standard, the first part of a tutorial on CP/M, an article on modifying the SDS Video Board for Pascal editor functions, the source code for an 8080 disassembler, a directory of Computerized Bulletin Board Systems (CBBS), and more. *S-100 Microsystems* will be published six times a year. A sample copy is $2. For subscriptions and additional information, contact *S-100 Microsystems*, POB 1192, Mountainside NJ 07092.

Circle 568 on inquiry card.

Short Form Catalog and Price List

Sara-Tech Electronics Inc, POB 692, Venice FL 33595, has published a catalog which includes systems and peripherals from Cromemco, North Star, Centronics, Heath, and many more companies. They also have a listing for computer-paper forms for all systems. Sara-Tech sells systems, peripherals, and software of most major companies.

Circle 569 on inquiry card.

A Book on Computerized Typesetting

Donald Knuth, author of *The Art of Computer Programming*, has written *TEX and METAFONT, New Directions in Typesetting*, which describes new techniques in typesetting. Dr Knuth explains how TEX, originally designed for use in setting technical and mathematical text, can be applied to all computerized typesetting. METAFONT is a system for the design of alphabets. It is suited for implementation on raster-based devices that print or display text. With it, computers can draw new fonts of characters in seconds. TEX and METAFONT represent improvements in typesetting that will benefit the scientific and technical community. The book consists of three parts. The first is a lecture on mathematical typography; the two other parts describe TEX and METAFONT. The book costs $12 and is available from Dept TM:X, Digital Press, Educational Services, Digital Equipment Corp, 12-A Esquire Rd, N Billerica MA 01862.

Circle 570 on inquiry card.

Software Catalog for Heath Users

The Heath Users' Group has published a catalog of programs written by Heath users for all Heath computers. The programs described include games, financial applications, utilities, computer-assisted education, and amateur radio. The catalog lists the language and designated computer next to the program. Prices are given, along with services of the Users' Group. For more information, contact Heath Users' Group, Hilltop Rd, St Joseph MI 49085.

Circle 571 on inquiry card.

What's New?

SYSTEMS

Intellivision from Mattel



Mattel Electronics is introducing six cartridges for its home computer system, Intellivision Intelligent Television. Soccer, Golf, Skiing, Boxing, Tennis, and Sea Battle join the existing fourteen cartridges, which range from sports and games to children's learning. Intellivision's Master Component contains a 16-bit microprocessor that delivers simulated sound effects, three-part harmony, and color reproduction. Two 12-button, hand-held controllers, each with four play-action keys, and a 16-directional control knob for movement of screen objects are included. The unit attaches to any television set.

The Keyboard Component uses programmed cassettes and features a keyboard and a digital cassette system with fast-forward and tape search. Its programs include Physical Fitness, Speed Reading, Stock Analysis, and Guitar Lessons. The Master Component will retail for approximately $300 or less. The Keyboard Component will cost around $550 and the cartridges will cost approximately $30, with the cassettes priced slightly under $30. For information, contact Mattel Electronics, 5150 Rosecrans Ave, Hawthorne CA 90250. Circle 586 on inquiry card.

Computer System from NNC

NNC Electronics, 15631 Computer Ln, Huntington Beach CA 92649, has released the System 80 computer. The System 80 uses a 4 MHz Z80 microprocessor and features a floppy-disk controller and two dual-density, 8-inch disk drives, 32 K bytes of programmable memory, two serial ports, and the CP/M operating system. The eight-slot S-100 card cage has five slots available for expansion. The desktop unit weighs less than 29 kg (65 pounds) and retails for $3995. Circle 587 on inquiry card.

Altos Announces a Hard-Disk System

The Altos Systems ACS8000-6 can take advantage of as much as 58 megabytes of hard disk storage. The system can control up to four 14.5-megabyte Shugart disks using Winchester-type technology. Altos designed the ACS8000-6 series so that it handles up to four floppy-disk drives. The floppy units could accommodate another 4.0 megabytes of on-line storage. The ACS8000-6 family comes with input/output (I/O) control to support two serial and two parallel ports in addition to the four serial ports to which the users are connected. The hard-disk controller features direct memory access (DMA) operation; firmware address checking; a high-speed first-in, first-out (FIFO) buffer; and intelligent sequencing. The controller firmware contains a routine that automatically double-checks all addresses before performing any disk writes. The FIFO enables the system to transfer data at a 7 million bits per second (bps). The system will support asynchronous, bisynchronous, and networking communications protocols and configurations. Prices range from $9450 for a single-user system with two floppy-disk drives and one 14.5-megabyte hard disk, to $14,260 for the four-user, 29-megabyte system with two dual-sided floppy-disk units. For details, contact Altos, 2338A Walsh Ave, Santa Clara CA 95050.



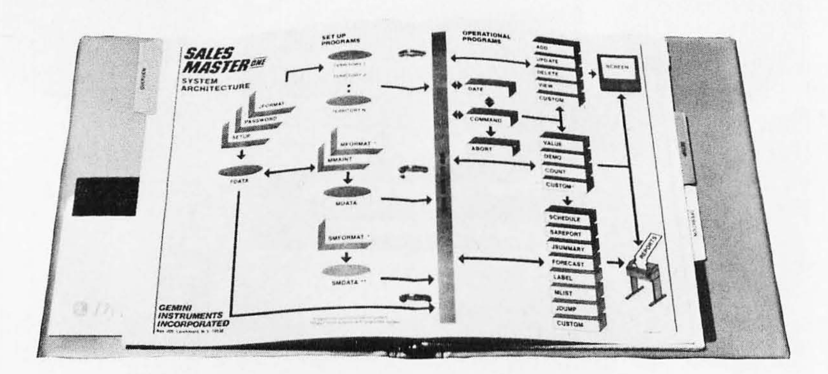
Circle 588 on inquiry card.

What's New?

SOFTWARE

A North Star Program for Salesmen

The Sales Master One is a collection of 22 programs designed by salespeople for salespeople. The Sales Master One is territory-oriented, allowing users to pinpoint selling activities to a particular location. The system generates reports on sales activities, forecasts, and schedules. Various other reports assist in daily selling efforts. The system has room for 400 jobs on one 5¼-inch floppy disk. The package contains a program that allows modifications to be made without the need to refer to the operations manual. A customized disk-operating system allows the package to be run on Cromemco, Dynabyte, and Processor Technology computers. Sales Master One comes on a 5¼-inch floppy disk with a manual for $375. Contact Gemini Instruments Inc, POB 205, Larchmont NY 10538.



Circle 573 on inquiry card.

Software from Compucolor

Compucolor Corp, POB 569, Norcross GA 30091, has released several software programs for the Compucolor II system.

The BASIC Editing package features six programs including FRED (Friendly Editor), RENUM (Renumber), MERGE, COMPAC, REMPAC (Deletes Remarks), and BASSRC (BASIC-to-Source Conversion). FRED, the most useful of the programs, allows the user to edit any line, move existing lines, delete a range of lines, and to search for the occurrence of any string, variable, or command within a program. The package comes on a floppy disk and costs $29.95.

Statistics is a series of three disks that is useful for engineering applications. The floppy disks are entitled *Statistics I, II,* and *III*. Each disk contains five programs including plot, stat, polreg (polynomial regression), index, and more. Common to all three packages is a file manager program that generates, maintains, and displays files for use by other programs. *Statistics I* sells for $24.95. *Statistics II* and *III* sell for $29.95 each.

Compucolor has also released Soundware. This program includes the software and hardware necessary to create sounds on the Compucolor II. It is written in BASIC, with a range of two to three octaves. The price is $49.95.

Circle 574 on inquiry card.

TLC-LISP for Z80 Systems

The LISP Company has announced its version of the LISP language for the Z80. TLC-LISP allows manipulation of functions as data objects; promotes object-oriented programming style; defines functions with a variable number of parameters; includes structured iteration and nonstructured escape mechanisms; contains complete string and character processing capabilities; and includes fixed- and floating-point arithmetic. The language system also contains a table-driven scanner; comprehensive error control, an autoload feature that "virtualizes" infrequently used functions and constants to disk files, freeing programmable memory; and execution speeds comparable to a KA-10 running MACLISP. Over 150 utility functions are provided. TLC-LISP is available for Z80 CP/M systems and other versions will be available soon. A detailed manual is $15, and the system on 5- or 8-inch floppy disks is $150. Write The LISP Co, POB 487, Redwood Estates CA 95044.

Circle 575 on inquiry card.

Software Catalog for TRS-80 Level II

National Software Marketing Inc, POB 6195, Hollywood FL 33021, has announced a free catalog of software for the TRS-80 Model II. The software described includes accounts receivable and payable, general ledger, payroll, inventory, rental mangagement, and a variety of financial and mathematical programs. These systems will operate on the 64 K-byte model with the built-in disk. The programs have list prices of $15 to $100.

Circle 576 on inquiry card.

A Gomoku Program

Five Stones Software, POB 1369, Station B, Ottawa, Ontario, K1P 5R4, CANADA, has released a Gomoku program for North Star Horizon disk-operating systems and CP/M-based systems. The program features a book of openings with 200 entries, the ability to take back moves, a 19 by 19 board, recent moves displayed along with the board, and the ability to customize to different screen sizes. The program requires a minimum of 32 K bytes of programmable memory and is available on 5-inch floppy disks for $29.95.

Circle 577 on inquiry card.

PLMX — A Language That Communicates with All 8- or 16-bit Microprocessors

PLMX is a universal high-level language for microprocessors. It can be used with all 8- or 16-bit microprocessors and was designed primarily for use in microcomputer product development systems and in real-time process-control applications. PLMX syntax is identical to PL/M, so the entire library of existing PL/M programs can be compiled under PLMX. PL/M programs may be used on microprocessors other than the 8080 through the PLMX compiler. PLMX is a true compiler, allowing fast compiling times —useful for real-time applications. It has been developed as a user-oriented language. There are no arbitrary formatting rules or line numbers. Comments may occur anywhere in the source text, except within reserved words, identifier names, and numbers. PLMX is priced at $1000, which includes an 8-inch compiler floppy disk and instruction manuals. To obtain additional information, write Systems Consultants Inc, Product Development Group, 4015 Hancock St, San Diego CA 92110.

Circle 578 on inquiry card.

What's New?

SOFTWARE

High-Speed Sort Utility for Ohio Scientific

BPSort is a high-speed, assembly language, sort/merge utility program for Ohio Scientific floppy and hard disk systems. It is capable of sorting 20 K bytes in ten seconds. Files can be an entire hard or floppy disk in length. BPSort handles fixed length records. Five keys can be specified for ascending and/or descending sequence. Sort parameters are established using a BASIC program. BPSort is OS-DMS compatible and is supplied as part of the BPS, an interactive data management system. It is sold in single-user licensed copies for $124. Earlier versions can be updated for $25. Order from BPS, 322 W 57th St, New York NY 10019.

Circle 579 on inquiry card.

Microsoft to Market muLISP and muMATH

Microsoft has become the distributor for muLISP-79 and muMATH-79, which were written by the Soft Warehouse of Honolulu, Hawaii. muLISP offers all of LISP's programming features, including 83 LISP functions, flexible program-control structures, and infinite precision integer arithmetic in any desired radix (2 to 36). The modular muMATH symbolic mathematics package is useful for scientific and engineering applications. The muMATH routines are written in muSIMP, which is included in the package. Both programs run with CP/M systems. The muLISP program costs $200 and the muMATH/muSIMP-79 program is priced at $250. Contact Microsoft, 10800 NE Eighth, Suite 819, Bellevue WA 98004.

Circle 581 on inquiry card.

Microsoft Announces TRS-80 Model II Software

Microsoft is selling TRSDOS-compatible versions of its COBOL and BASIC compilers for the TRS-80 Model II. Both compilers provide complete facilities for commercial or in-house software development, including Microsoft's macroassembler and linking loader. The COBOL-80 compiler is an ANSI-74 implementation of COBOL. The BASIC compiler produces object code that runs faster than interpreted BASIC programs. All Microsoft BASIC language features are supported. The BASIC compiler is also available in a version for the TRS-80 Model I. Microsoft is the author of Radio Shack's BASICs. The BASIC compiler is $395,and the COBOL-80 compiler is $750. Contact Microsoft, 10800 NE Eighth, Suite 819, Bellevue WA 98004.

Circle 580 on inquiry card.

Six Programs for TRS-80 Level II and Disk-Operating System

International Data Services has developed Microsketch III, a graphics program for the Level II with 16 K bytes of programmable memory for $7.95. Freakout is a keyboard-generated graphics and sound program for the Level II with 4 K bytes of programmable memory for $3.95. The number-base conversion program converts any base to any other base between 2 and 16. It is priced at $3.95. Three other programs are available for disk BASIC with 16 K bytes of programmable memory. BASIC to Electric Pencil file conversion, machine language to BASIC data statement conversion, and mail-list file uppercase to uppercase-and-lowercase conversion programs all cost $3.95. Contact IDS, 340 W 55th St, New York NY 10019.

Circle 582 on inquiry card.

RCA's BASIC I Compiler/Interpreter for COSMAC Development System

RCA's BASIC I Compiler/Interpreter CDP18S834 is a software package that can accelerate program development on the COSMAC DOS Development System CDP18S007. The package gives the user the option of developing and running programs in BASIC I or converting the programs to object code. The output of the compiler is assembled by the COSMAC macroassembler to produce the executable object code. Some of the features of the compiler/interpreter include: 70 characters per line, variable designation by a single capital letter, and fixed-point arithmetic. BASIC I functions include MOD, AND, OR, XOR, and USR. The USR function extends BASIC I by means of machine-language subroutines. Some of the statements available to the programmer are REM, LET, GOTO, IF, INPUT, WFLN, and NEW. With a manual, the package is priced at $300. Contact RCA Solid State Div, POB 3200, Somerville NJ 08876.

Circle 583 on inquiry card.

A Data Base System for the TRS-80

V R Data Corp, 777 Henderson Blvd, Folcroft PA 19032, has announced a Data Base system for the TRS-80 Models I and II. The Data Base system provides the capability to define and create customized records for various applications. Records may contain up to 25 user-defined variable-length fields and up to 250 characters per record. A dictionary of the fields and their characteristics is maintained by the system. Records may be added, deleted, and extended; field contents may be changed, and fields may be removed or added to the record or renamed at any time. Records may also be linked logically. The records may be sorted by any combination of fields in ascending or descending order. Reports are fully user-definable and may be routed to a printer or the video display. This four-program BASIC system requires 48 K bytes of programmable memory, a minimum of two disk drives and a line printer for the TRS-80 Model I, with 300 records per disk. Programs are available for the Model II with 950 records per disk.

Circle 584 on inquiry card.

Machine-Language Program for TRS-80 Disk Systems

The ST80-111 machine-language program is written for the TRS-80 Level II system. This package includes programs that allow users to talk to a time-sharing computer, transfer files to and from the central computer, and customize the ST80-111 system. Some of the programs included in the system are a BASIC program that creates translation tables, one that tells if a file is American Standard Code for Information Interchange (ASCII) or binary, a binary-to-ASCII conversion program, and one that changes machine-language programs to binary. The ST80-111 has been run on HP2000, IBM 370 and 360, PDP-11, Burroughs, Apple, and North Star systems. The minimum requirements for the system are the TRS-80 Level II with one disk drive and 16 K bytes of memory, an RS-232C board, and a modem. The package is produced by Small Business Systems Group, Main St and Lowell Rd, Dunstable MA 01827, and is priced at $150.

Circle 585 on inquiry card.



Circle 236 on inquiry card.

TRS-80 Model I and II quality software

DATA BASE MANAGER IDM-IV $69
You can use it to maintain a data base & produce reports without any programming. Define file parameters & report formats on-line. Features key random access, fast multi-key sort, field arith., label generator, audit log. MOD-II version with more than 50 enhancements $199.

ACCOUNTS RECEIVABLE ACCT-III $69
One or more drives. Order entry calculates sales tax, shipping, amount for multiple items. Credit checking, aging, sales analysis, invoices, statements and reports. As opposed to most other A/R, ours can be used by doctors, store managers, etc. MOD-II version $149.

WORD PROCESSOR 16K $39. 32K $49. MOD-II $49.
First word processor specifically designed for the TRS-80 that uses disk storage for text. Written in BASIC. No special hardware and text limit. Use for letters, manuals & reports. 32K version features upper/lower case without hardware change and multiple input text files.

MAILING LIST advanced MAIL-V $59.
Fast sort by any field. Multiple labels and reports. 4-digit selection code, new zip code ext., screen input, live keyboard, powerful report writer. MOD-II $99.

INVENTORY INV-V $99.
9-digit alphanumeric key for fast key random access. Reports include order info, performance summary, etc. Calculate E.O.Q. Powerful report writer. MOD-II $149.

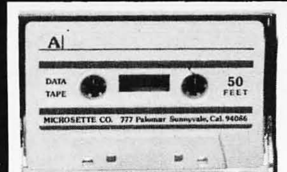
All programs are on-line, interactive, random access, virtually bug free, documented and delivered on disks. MOD-I requires 32K, DOS. We challenge all software vendors to offer low cost manuals so you can compare and avoid those high-priced undocumented, 'on-memory' programs. Send $5 for a MOD-I manual and $10 for MOD-II.

MOD-II programs are extensively modified, guaranteed to run with 1 year newsletter & updates. 10% off for ordering more than 1 MOD-II programs.

MICRO ARCHITECT
96 Dothan St., Arlington, MA 02174

Circle 237 on inquiry card.

C-10 **SHORT CASSETTES** 50 FT.



Qty.	Price
1	$1.00
10	$0.75
50	$0.65

Premium tape and cassettes acclaimed by thousands of repeat order microcomputer users. Price includes labels, cassette box and shipping in U.S.A. VISA and M/C orders accepted. California residents add sales tax. Phone (415) 968-1604.

MICROSETTE CO.
475 Ellis Street
Mt. View, CA 94043

Circle 238 on inquiry card.

TRS-80 II

TWO NEW CASSETTES

• VENTURE ANALYSIS •
ANALYSE VARIOUS EFFECTS IN MINUTES
7 YR RESULTS INCLUDE:
REVENUES, COSTS
BT & AT EARNINGS
UNDEPRECIATED CAPITAL
CASH FLOW — ROIC
AND OTHERS
16 K 14.95

• DUPL. BRIDGE SCORING •
4, 5, 6 TABLES
HOWELL MOVEMENT — ENTER SCORES, BOARD AND PLAYER TOTALS
16K 6.95

Check or M.O. To:

RLK SOFTWARE
1310 E. Clarendon St.
Arlington Heights, IL 60004

Circle 239 on inquiry card.

Look to Aristo/Polks for reliability, quality, product versatility and value

IN NEW YORK CITY

OHIO SCIENTIFIC & ARISTO/POLKS FULL STOCK AND SERVICE ON CHALLENGER MICROCOMPUTERS.

CHALLENGER C1P 8K	$399.00
C1P 5" FLOPPY 20K	$1198.00
SUPERBOARD C1P	$279.00
CHALLENGER (COLOR) C4P 8K	$698.00
C4P FLOPPY 24K 5"	$1698.00
CHALLENGER C8P	$895.00
COLOR-DUAL 8" FLOPPY C8P	$2597.00
C-3 48K DUAL FLOPPY 8"	$3995.00
C-3 + 23 MEG HARD DISK	$9900.00
C-2-OEM 48K DUAL FLOPPY 8"	$2699.00

PLUS ALL SOFTWARE & PERIPHERALS

Mail order invited if machine can be sent back to us for service. 220V conversions available for systems-write for quote. Write for free catalog. *M/C, VISA, AX CARDS ACCEPTED.*

Aristo/Polks • 212-279-9034
314 5TH AVE.(32 ST) N.Y.C., N.Y. 10001
9:30/6-DAILY ■ THURS TIL 9 ■ SUNDAY 11-5

Circle 240 on inquiry card.

BUSINESS SOFTWARE
CP/M AND MODEL II COMPATIBLE
NEWLY ENHANCED VERSIONS

MEDICAL MGMT SYSTEMS	$495
DENTAL MGMT SYSTEM	$495
REAL ESTATE MULTI-LIST	$495
INSURANCE AGENCY MGMT	$495
LEGAL TIME ACCOUNTING	$495
GENERAL LEDGER	$495
ACCOUNTS PAYABLE	$495
ACCOUNTS RECEIVABLE	$495
PAYROLL PROCESSING	$495
INVENTORY MANAGEMENT	$495
WORD PROCESSING/NAD	$495
DATABASE MANAGEMENT	$495
HIGH-SPEED UTILITY SORT	$300
NEW! LATEST CBASIC-2	$ 99
NEW! LATEST MBASIC 5.1	$300
NEW! MBASIC COMPILER	$350
* *CP/M 2.0 FOR MODEL II	$170
COMPLETE SOFTWARE CATALOG	5
COMPLETE HARDWARE GUIDE	5

UNIVAIR, INC. 314-426-1099
10327 LAMBERT INTL AIRPORT
ST. LOUIS, MISSOURI 63145 USA
MASTER CHARGE/VISA CARDS O.K.

Circle 241 on inquiry card.

SURPLUS INVENTORY

NEW $99 — **22 MHz BANDWIDTH**

***SOLID STATE MONITORS:** Sylvania 12" B&W CRT, 22 MHz video bandwidth, 800 line resolution! ASL Model C12ACB. OEM tabletop style without case. P4 phosphor. Inputs = separate video, horz. & vert. pos. sync pulses at nominal TTL/CMOS levels. Any sweep rate, 10-20 KHz. 115 VAC. Simple TRS-80 hookup, add 2 jumpers. With full maint. manual incl. timing, schematics, TRS-80 hookup etc. Used, re-checked, very clean, no burns **$77**. New, checked, ... **$99**

2102 BONANZA: Prime, brand new static 1024x1 RAM. Fairchild F-2102-FPC, 350 ns. Sold in sleeves of 25. 1-3 sleeves at $20 ea, 4-9 sleeves at $16 ea. 10 sleeves and up at $10 per sleeve, that's prime, new 2102s at .... **$ .40 ea**

***S100 CORE SALE:** Brand new, tested Ampex core. See article "IT'S TIME FOR CORE" (9/79 Kilobaud p. 34) which describes an easily built interface between this core and an S-100 machine. But ignore the prices in the article! Sale priced, including large documentation pkg. 8K boards **$99** 16K boards **$230.** Add $4 for schematics of core.

***OTHER SURPLUS BARGAINS:** **HARD DISKS,** new w/manual $895. **SHUGART SA800-1/801** floppies w/manual, new $425. Full **ASCII KEYBOARDS** $44. **TOUCHTONE DECODERS $66.**

TERMS: UPS Included 48 states except disk drives. UPS COD add $1.25. VISA & MC add 4%. NJ add sales tax. Everything guaranteed. Immediate shipment or immediate refund. Phone orders and questions are welcome.

* **Write or call for full spec sheets on specific items.**

ELECTRAVALUE INDUSTRIAL
P.O. BOX 157-B
MORRIS PLAINS, NJ 07950
Phone orders are welcome.
201/267-1117

GAME DESIGN

Leading Coin-op Amusement Game company will consider use of YOUR pinball, video or other game idea on a royalty, commission or other basis. WRITE FOR DISCLOSURE FORM BEFORE SUBMITTING GAME IDEA.

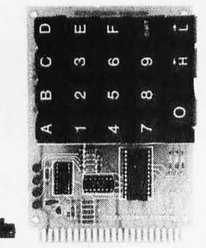
Department BMA
P.O. Box 236
Bensenville, IL 60106



Circle 244 on inquiry card.

HEX ENCODED KEYBOARD

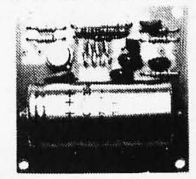
Four onboard LEDs indicate the HEX code generated for each key depression. The board requires a single +5 volt supply. Board only $15.00 Part No. HEX-3, with parts $49.95 Part No. HEX- 3A. 44 pin edge connector $4.00 Part No. 44P.



ASCII TO CORRESPONDENCE CODE CONVERTER

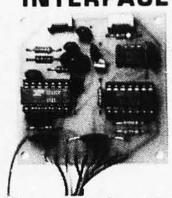
This bidirectional board is a direct replacement for the board inside the Trendata 1000 terminal. The on board connector provides RS-232 serial in and out. Sold only as an assembled and tested unit for $249.95. Part No. TA 1000C

T.V. INTERFACE



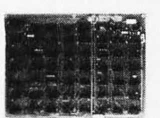
• Converts video to AM modulated RF, Channels 2 or 3. So powerful almost no tuning is required. On board regulated power supply makes this extremely stable. Rated very highly in Doctor Dobbs' Journal. Recommended by Apple • Power required is 12 volts AC C.T., or +5 volts DC • Board only $7.60 part No. 107, with parts $13.50 Part No. 107A

TAPE INTERFACE



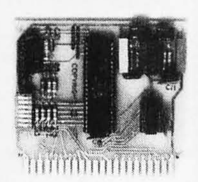
• Converts a low cost tape recorder to a digital recorder • Works up to 1200 baud • Digital in and out are TTL-serial • Output of board connects to mic. in of recorder • Earphone of recorder connects to input on board • No coils • Requires +5 volts, low power drain • Board only $7.60 Part No. 111, with parts $29.95Part No. 111A

T.V. TYPEWRITER



• Stand alone TVT • 32 char/line, 16 lines, modifications for 64 char/line included • Parallel ASCII (TTL) input • Video output • 1K on board memory • Output for computer controlled curser • Auto scroll • Non-destructive curser • Curser inputs: up, down, left, right, home, EOL, EOS • Scroll up, down • Requires +5 volts at 1.5 amps, and -12 volts at 30 mA • All 7400, TTL chips • Char. gen. 2513 • Upper case only • Board only $39.00 Part No. 106, with parts $145.00 Part No. 106A

UART & BAUD RATE GENERATOR



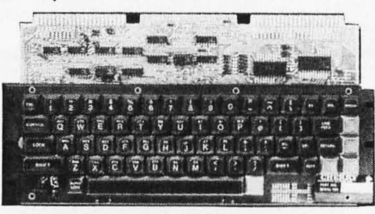
• Converts serial to parallel and parallel to serial • Low cost on board baud rate generator • Baud rates: 110, 150, 300, 600, 1200, and 2400 • Low power drain +5 volts and -12 volts required • TTL compatible • All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity. • All connections go to a 44 pin gold plated edge connector • Board only $12.00 Part No. 101, with parts $35.00 Part No. 101A, 44 pin edge connector $4.00 Part No. 44P

ASCII KEYBOARD

53 Keys popular ASR-33 format • Rugged G-10 P. C. Board • Tri-mode MOS encoding • Two-Key Rollover • MOS/DTL/TTL Compatible • Upper Case lockout • Data and Strobe inversion option • Three User Definable Keys • Low contact bounce • Selectable Parity • Custom Keycaps • George Risk Model 753. Requires +5, -12 volts. $59.95 Kit.

ASCII KEYBOARD

TTL & DTL compatible • Full 67 key array • Full 128 character ASCII output • Positive logic with outputs resting low • Data Strobe • Five user-definable spare keys • Standard 22 pin dual card edge connector • Requires +5VDC, 325 mA. Assembled & Tested. Cherry Pro Part No. P70-05AB. $119.95.

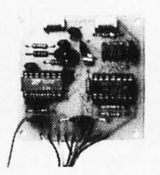


SOROC IQ 120



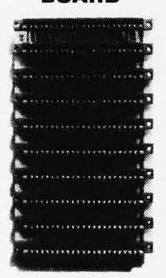
Upper/lower case display • Numeric keypad & cursor keys • Protected fields, ½ intensity display • RS 232 interface & aux. port. IQ120—$799.95 • IQ140 Detachable keyboard—$1199.95

MODEM



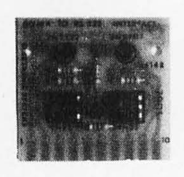
• Type 103 • Full or half duplex • Works up to 300 baud • Originate or Answer • Serial TTL input and output • connect 8 Ω speaker and crystal mic. directly to board • Requires +5 volts • Board only $7.60 Part No. 109, with parts $29.95 Part No. 109A.

44 BUS MOTHER BOARD



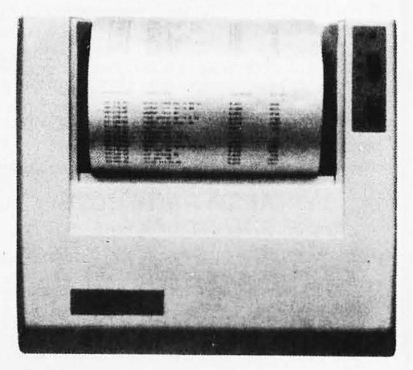
Has provisions for ten 44 pin (.156) connectors, spaced 3/4 of an inch apart. Pin 20 is connected to X, and 22 is connected to Z for power and ground. All the other pins are connected in parallel. This board also has provisions for bypass capacitors. Board cost $15.00 Part No. 102. Connectors $3.00 each Part No. 44WP.

RS-232/20mA INTERFACE



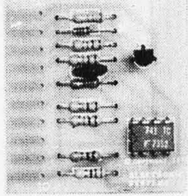
This board has two passive, opto-isolated circuits. One converts RS-232 to 20mA, the other converts 20mA to RS-232. All connections go to a 10 pin edge connector. Requires +12 and -12 volts. Board only $9.95, part no. 7901, with parts $14.95 Part No. 7901A.

COMPRINT PRINTER



Printing Characteristics: 225 characters/second (170 lines/minute) throughput • 9 horizontal x 12 vertical matrix • 96 ASCII character set with upper and true lower case • 80 characters/line • 5.8 lines/inch
Buffer Memory: standard 256 bytes; • optional; 2,048 bytes (buffer memory option designated as Model 912-2K), add $149.95.
Paper Requirements: electrosensitive type (aluminum coated) • 8-1/2 inch width • 3.7 inch max. (300 ft.) roll diameter.
Model 912-S Interfacing: serial interface RS232 and 20 mA current loop • BAUD rates 110, 150, 300, 600, 1200, 2400 and 4800 are strap selectable.
Model 912-P Interfacing: parallel interface, IEEE-488 and 8 bit parallel (strobe/ acknowledge). Model 912-S, Part No. CPIA, 32118, $579.95. Model 912-P, Part No. CPIA, 32117, $559.95.

RS-32/TTL INTERFACE



• Converts TTL to RS-232, and converts RS-232 to TTL • Two separate circuits • Requires -12 and +12 volts • All connections go to a 10 pin edge connector, kit $9.95 Part No. 232A 10 Pin edge connector $3.00 part No. 10P.

COMPUCOLOR II



With reg. keyboard MOD3 8K $1595.95 MOD4 16K $1695.95 MOD5 32K $1995.95 Now includes $250 more, worth of software and accessories with 101 key option add $134.95 with 117 key option add $179.95

DC POWER SUPPLY

• Board supplies a regulated +5 volts at 3 amps., +12, -12, and -5 volts at 1 amp. • Power required is 8 volts AC at 3 amps., and 24 volts AC C.T. at 1.5 amps. • Board only $12.50 Part No. 6085, with parts excluding transformers $42.50 Part No. 6085A



To Order: Mention part no. description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U. S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U. S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800

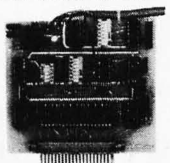


Send for FREE Catalog . . . a big self-addressed envelope with 41¢ postage gets it fastest!

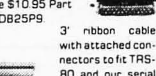
ELECTRONIC SYSTEMS Dept. B P. O. Box 21638, San Jose, CA USA 95151

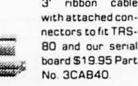
TRS-80 SERIAL I/O

• Can input into basic • Can use LLIST and LPRINT to output, or output continuously • RS-232 compatible • Can be used with or without the expansion bus • On board switch selectable baud rates of 110, 150, 300, 600, 1200, 2400, parity or no parity odd or even, 5 to 8 data bits, and 1 or 2 stop bits. D.T.R. line • Requires +5, -12 VDC • Board only $19.95 Part No. 8010, with parts $59.95 Part No. 8010A, assembled $79.95 Part No. 8010 C. No connectors provided, see below.



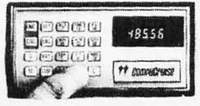
EIA/RS-232 connector Part No. DB25P $6.00, with 9', 8 conductor cable $10.95 Part No. DB25P9.





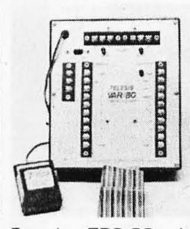
3' ribbon cable with attached connectors to fit TRS-80 and our serial board $19.95 Part No. 3CAB40.

COMPUCRUISE



$129.95; with cruise control $169.95

THE TELESIS VAR-80 INTERFACE UNIT



For the TRS-80 with Level II Basic • Provides 8 outputs • Provides 8 inputs • 2 ft. of interconnecting cable w/connector • Plugs directly into TRS-80 • Power supply provided • Assembled and tested. Part No. VAR80, Introductory price $109.95.

GAME PADDLES & SOUND



Includes: 2 game paddles, interface, software, speaker, power supply, full documentation including: schematics, theory of operation, and user guide; plus 2 games on cassette (Pong and Starship War). $79.95 Complete Part No. 7922C

DIGICOM DATA PRODUCTS INC. Series 312 Acoustic Coupler



300 BAUD Originate, Part No. AC3122, $219.95. 300 BAUD Answer, Part No. AC3122, $219.95. 300 BAUD Answer/Originate, Part No. AC3123, $229.95.

LIGHT-PEN For Your TRS-80



Your TRS-80 Light-Pen is a carefully engineered instrument and with the proper care will give satisfactory use and many years of service. Part No. TRS80LP $24.95.

SYSTEM EXPANSION from LNW Research

• Serial RS232C/20 mA I/O • Floppy controller • 32K bytes memory • Parallel printer port • Dual cassette port • Real-time clock • Screen printer bus w/ • Onboard power supply • Software compatible • Solder mask, silk screen. PC board and user manual, Part No. LNW80, $69.95.

DISKETTES

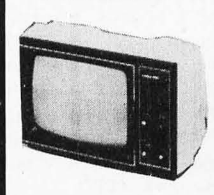


Box of 10, 5" $29.95, 8" $39.95. Plastic box, holds 10 diskettes, 5" - $4.50, 8" - $6.50.

16K RAMS

For the Apple, TRS-80 or Pet $8 each Part No. 4116/2117.

LEEDEX MONITOR



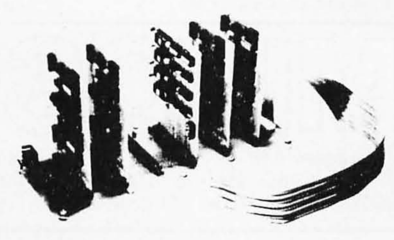
12" Black and White • 12 MHz Bandwidth • Handsome Plastic Case • $139.00

S-100 INTERFACE



AN S-100 bus Adapter—Motherboard for the TRS-80. Kit, Part No. HUH81DLXK, $295.95. Assembeled, Part No. HUH81DLXA, $375.95.

NOW! A FULL SUPPORT SYSTEM FOR TRS-80

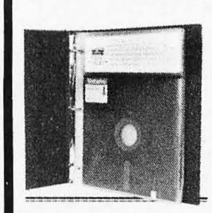


• 32K of RAM • EPROM firmware • Disk control • Data acquisition • Parallel I/O • Serial I/O • Plug into GPA's Motherboard. GPA's quality design includes • 6-44 pin edge connectors • +5V, -5V, +12V, -12V external power supply required • Active termination. The Motherboard, Part No. GPA80, is only $149.95.

TAKE ADVANTAGE OF GPA-EXPANSION CARDS FOR THE GPA80

Memory cards: Now with Fortran compilers available for your TRS-80, additional expansion memory is a must! Card with sockets only, Part No. GPA801, $119.95. Card with 16K of 4116 Dynamic Ram, Part No. GPA802, $224.95. Card with 32K of 4116 Dynamic Ram, Part No. GPA803, $329.95. All cards come equipped with sockets to accomodate 32K of Ram. **EPROM firmware card.** Put those valuable subroutines in firmware. Don't waste time loading and unloading tapes and disks. For 2708 or 2716 EPROMS, Part No. GPA806, $79.95. **Serial I/O card.** Here's what you've been asking for, a full serial terminal interface, with RS-232C or 20 mA. Current loop. Input/output capabilities. Part No. GPA807, $79.95. **Parallel I/O Card.** Control functions in the outside world, monitor and store real time events. Two parallel output ports. Dip switches select ports (0-254). Part No. GPA808, $79.95.

FLOPPY DISK STORAGE BINDER



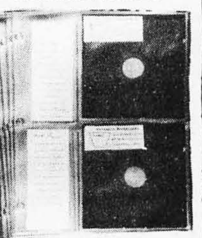
Three-ring binder comes with ten transparent plastic sleeves which accommodate either twenty, five-inch or ten, eight-inch floppy disks. Binder & 10 holders $14.95 Part No. 8800; Extra holders 95¢ each. Part No. 800.

DIGITAL CASSETTE



5 min. each side. Box of 10 $9.95. Part No. C-5.

DISK JACKET™



Holds two 5-1/4 inch diskettes and will fit any standard three ring binder. $9.95/10 Pack.

TRENDCOM PRINTER



• 40 characters per second • 4-7/16 inch wide thermal paper • Graphics (TRENDCOM 100): 480 sevendot print postions per line. TRENDCOM 100, Part No. TRC0100, $495.95. TRENDCOM 200, Part No. TRC0200, $375.95. **Interface** for TRS-80, Part No. T80A $45.95. For Apple II, Part No. TRCAII, $75.95. For PET, NO. TRCP2, $79.95. For Scoccerer, TRCSR1 $45.95.

SARGON: A Computer Chess Program

Features the complete program that won the 1978 West Coast Computer Faire Tournament. Part No. 00603 — TRS-80 Level II; Part No. 00604 — Apple II (24K). $19.95

SOUND EFFECTS AND MUSIC FOR YOUR COMPUTER



SOUNDWARE is a complete system. It includes a speaker/amplifier unit with volume control, earphone jack, and connectors. It boasts excellent tone quality yet is small and convenient to use. Add batteries, plug it in, and play. One year warranty. SOUNDWARE package (includes INTRO to SOUNDWARE programs) PET (8K), Part No. 20003, $29.95. TRS-80 Level II (16K), Part No. 20002, $29.95. Compucolor II (8K), Part No. 20001, $39.95. INTRO to SOUNDWARE programs only PET and TRS-80, Part No. 20005, $14.95. Compucolor II Part No. 20006, $19.95.

To Order: Mention part no. description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U.S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U.S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800



Send for FREE Catalog . . . a big self-addressed envelope with 41¢ postage gets it fastest!

ELECTRONIC SYSTEMS Dept. B P. O. Box 21638, San Jose, CA USA 95151

Circle 246 on inquiry card.

Circle 247 on inquiry card.

P.O. Box 4430X, Santa Clara, CA 95054
Will calls: 2322 Walsh Ave.
(408) 988-1640

Quest ELECTRONICS

NEW PRODUCTS!

Super Color S-100 Video Kit $99.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc.

Gremlin Color Video Kit $59.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. Not expandable to high resolution Graphics.

Elf II Adapter Kit $24.50

Plugs into Elf II providing Super Elf 44 and 50 pin bus plus S-100 bus expansion (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

1802 16K Dynamic RAM Kit $149.00

1802/S-100 expandable to 32K, Hidden refresh w/clocks up to 4 MHz w/no wait states Addl. 16K RAM **$79.00.**

Quest Super Basic

Quest, the leader in inexpensive 1802 systems announces another first. Quest is the first company worldwide to ship a **full size Basic** for 1802 systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm.17E^{38}$), 32 bit integer ± 2 billion; Multi dim arrays; String arrays; String manipulation; Cassette I/O, Save and load, Basic, Data and machine language programs; and over 75 Statements, Functions and Operators.

Easily adaptable on most 1802 systems. Requires 12K RAM minimum for Basic and user programs. Cassette version in stock now. ROM versions coming soon with exchange privilege allowing some credit for cassette version.

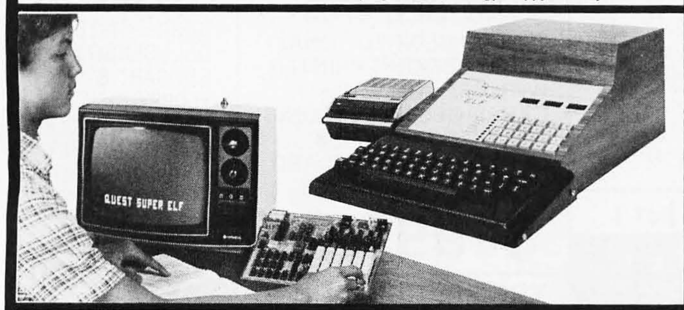
Super Basic on Cassette $40.00

Tom Pittman's 1802 Tiny Basic Source listing now available. Find out how Tom Pittman wrote Tiny Basic and how to get the most out of it. Never offered before. $19.00

S-100 4-Slot Expansion $ 9.95

Super Monitor VI.I Source Listing $15.00

Coming Soon: Assembler, Editor, Disassembler, DA/AD, Super Sound/Music, EPROM programmer, Stringy Floppy Disc System.



RCA Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R & D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** Expansion Cabinet with room for 4 S-100 boards **$41.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year. Issues 1-12 bound $16.50.

Tiny Basic Cassette **$10.00,** on ROM **$38.00,** original Elf kit board **$14.95. 1802 software;** Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface.** Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf.** The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes.

A IK Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

INTEGRATED CIRCUITS

7400TTL

7400N	.17
7402N	.18
7404N	.19
7409N	.23
7410N	.18
7414N	.70
7420N	.18
7422N	.39
7430N	.20
7442N	.50
7445N	.69
7447N	.60
7448N	.69
7450N	.18
7474N	.35
7475N	.49
7485N	.88
7489N	1.85
7490N	.43
7492N	.43
7493N	.43
7495N	.69
74100N	.90
74107N	.35
74121N	.34
74123N	.59
74125N	.45
74145N	.69
74150N	.95
74151N	.69
74154N	1.00
74157N	.69
74161N	.87
74162N	.87
74163N	.87
74174N	.96
74175N	.90
74190N	1.15
74192N	.87
74193N	.85
74221N	2.00
74298N	1.65
74365N	.66
74366N	.66
74367N	.66

74LS00 TTL

74LS00N	.35
74LS02N	.35
74LS04N	.35
74LS05N	.35
74LS08N	.35
74LS10N	.35
74LS13N	.55
74LS14N	1.10
74LS20N	.35
74LS22N	.35
74LS28N	.41
74LS30N	.35
74LS33N	.75
74LS38N	.55
74LS74N	1.25
74LS75N	1.00
74LS90N	.85
74LS93N	.70
74LS95N	1.10
74LS107N	.45
74LS112N	.45
74LS113N	.35
74LS132N	.89
74LS136N	.45
74LS151N	.85
74LS155N	.85
74LS157N	.85
74LS162N	1.15
74LS163N	1.15
74LS174N	2.00
74LS190N	1.06
74LS221N	1.95
74LS258N	.67
74LS367N	1.35

LINEAR

CA3045	.90
CA3046	1.10
CA3081	1.80
CA3082	1.90
CA3089	2.95
LM301AN/AH	.35
LM305H	.87
LM307N	.35
LM308N	.89
LM309K	1.50
LM311H/N	.90
LM317T/K	3.75
LM318	1.35
LM320K-5	1.50
LM323K-5	5.95
LM320K-12	1.50
LM320K-15	1.50
LM320T-5	1.60
LM320T-8	1.60
LM320T-12	1.50
LM320T-15	1.60
LM324N	1.15
LM339N	1.55
LM340K-5	1.35
LM340K-8	1.35
LM340K-12	1.35
LM340K-15	1.35
LM340K-24	1.35
LM340T-5	1.25
LM340T-8	1.25
LM340T-12	1.25
LM340T-15	1.25
LM340T-18	1.25
LM340T-24	1.25
LM343H	4.50
LM350	7.50
LM370	1.15
LM377	3.00
LM379	5.00
LM380N	1.00
LM381	1.60
LM382	1.60
LM703H	.40
LM709H	.28
LM723H/N	.50
LM733N	.67
LM741CH	.35
LM741N	.32
LM747H/N	.75
LM748N	.35
LM1303N	1.75
LM1304	1.10
LM1305	1.27
LM1307	2.00
LM1310	2.75
LM1458	.47
LM1800	1.75
LM1812	7.50
LM1889	3.00
LM2111	1.75
LM2902	1.50
LM3900N	.60
LM3905	1.75
LM3909N	.89
MC1458V	.50
NE540H	3.75
NE550N	1.00
NE555V	.39
NE556A	.85
NE565A	1.00
NE566V	1.50
NE567V	1.00
NE570B	5.00
78L05	.60
78L08	.60
78M05	.85
75108	1.75
75491CN	.50
75492CN	.55
75494CN	.89

A to D CONVERTER

8038B	4.50
8700CJ	13.95
8701CN	22.00
8750CJ	13.95
LD130	9.95
9400CJV/F	7.40
ICL7103	9.50
ICL7107	14.25

CMOS

CD34001 Fair.	.50
CD4000	.16
CD4001	.28
CD4002	.28
CD4006	1.10
CD4007	.28
CD4008	.28
CD4009	.45
CD4010	.45
CD4011	.28
CD4012	.28
CD4013	.39
CD4014	1.00
CD4015	1.00
CD4016	.45
CD4017	1.05
CD4018	.94
CD4019	.45
CD4020	1.02
CD4021	1.25
CD4022	1.10
CD4023	.28
CD4024	.75
CD4025	.28
CD4026	2.00
CD4027	.66
CD4028	.85
CD4029	1.02
CD4030	.45
CD4035	1.02
CD4040	1.02
CD4042	.85
CD4043	.85
CD4044	.85
CD4046	1.67
CD4049	.45
CD4050	.49
CD4051	1.13
CD4060	1.42
CD4066	.71
CD4068	.40
CD4069	.40
CD4070	.50
CD4071	.28
CD4072	.28
CD4073	.28
CD4075	.28
CD4076	1.45
CD4078	.40
CD4081	.28
CD4082	.28
CD4116	.47
CD4490	5.50
CD4507	1.00
CD4508	4.25
CD4510	1.02
CD4511	.94
CD4515	2.52
CD4516	1.10
CD4518	1.02
CD4520	1.02
CD4527	1.51
CD4528	.79
CD4553	3.50
CD4566	2.25
CD4583	4.50
CD4585	1.10
CD40192	3.00
74C00	.28
74C04	.40
74C10	.28
74C14	2.10
74C20	.28
74C30	.28
74C48	1.95
74C74	.75
74C76	1.40
74C90	1.15
74C93	1.40
74C154	3.00
74C160	1.44
74C175	1.35
74C192	1.65
74C221	2.00
74C905	6.00
74C906	.75
74C914	1.95
74C922	5.50
74C923	5.50
74C925	6.95
74C926	6.95
74C927	6.95

INTERFACE

8095	.65
8096	.65
8097	.65
8098	.65
8T09	1.25
8T10	4.50
8T13	3.00
8T20	5.50
8T23	3.10
8T24	3.50
8T25	3.20
8T26	1.69
8T28	2.75
8T97	1.69
8T98	1.69

MOS/MEMORY RAM

2101-1	3.95
2102-1	.95
2102AL-4	1.25
2102AN-2L	1.60
21L02-1	1.18
2104A-4	4.95
2107B-6	3.75
2111-1	3.75
2112-2	3.95
2114L 300ns	7.40
4116 200ns	9.50
8/4116 200ns	64.00
2513B	6.30
MM5262	.40
MM5280	3.00
MM5320	9.95
MM5330	5.94
PD411D-3	4.00
PD411D-4	5.00
P5101L	8.95
4200A	9.95
82S25	2.90
91L02A	1.50
HD0165-5	6.95
MM57100	4.50
GIAY38500-1	9.95
MCM66751A	9.95
9368	3.50
410D	10.00
416	16.00

CLOCKS

MM5311	5.50
MM5312	3.90
MM5314	3.90
MM5369	2.10
MM5841	14.45
MM5865	7.95
CT7001	5.80
CT7010	8.95
CT7015	8.95
MM5375AA/N	3.90
MM5375AG/N	4.90
7205	16.50
7207	7.50
7208	15.95
7209	4.95
DS0026CN	3.75
DS0056CN	3.75
MM53104	2.50

MICROPROCESSOR

6502	12.50
6504	16.50
6522	13.60
6800	17.50
6802	18.75
6820	9.95
6850	12.95
8080A	8.95
8085	27.00
8086	75.00
Z80	14.75
Z80A	19.75
8212	2.90
8214	8.00
8216	2.90
8224	2.90
8228	5.35
8251	8.50
8253	15.00
8255	9.25
8257	19.50
8259	19.50
1802CP plas	13.95
1802DP plas	17.95
1861P	11.50
CDP1802CD	19.95
CDP1802D	25.00
CDP1861	12.95

UART/FIFO

AY5-1013	5.50
AY5-1014	7.50
3341	6.95

PROM

1702A	3.95
2513B upper case	6.95
2708	7.75
2716T1	24.50
2716 Intel	34.95
8/2716 Intel	240.00
2732	85.00
2758	22.50
8741A	85.00
8748	75.00
8748-8	70.00
8755A	65.00
N82S23	2.95
N82S123	3.50
N82S126	3.75
N82S129	3.75
N82S131	3.75
N82S136	8.75
N82S137	8.75
DM8577	2.90
8223	2.90
8/2716 Intel	240.00

CONNECTORS

30 pin edge	2.50
44 pin edge	2.75
100 pin edge	4.50
100 pin edge WW	5.25

IC SOCKETS

Solder Tin Low Profile

PIN	1 UP	PIN	1UP
8	.15	22	.30
14	.14	24	.35
16	.16	28	.42
18	.27	36	.58
20	.29	40	.57

2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN		PIN	
14	.32	24	.86
16	.33	28	1.00
18	.57	40	1.23

CRYSTALS

1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
5 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 Hz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.20
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

KEYBOARD ENCODERS

AY5-2376	$12.50
AY5-3600	17.95
AY5-9100	10.50
AY5-9200	16.50
74C922	5.50
74C923	5.50
HD0165-5	6.95

D Connectors RS232

DB25P	2.95
DB25S	3.95
Cover	1.50
RS232 Complete Set	6.50
DE9S	1.95
DA15P	2.10
DA15S	3.10

Hickok 3½ Digit LED multimeter	**69.95**
Stopwatch Kit	**26.95**
Auto Clock Kit	**17.95**

Not a Cheap Clock Kit $14.95
Includes everything except case. 2-PC boards. 6-.50" LED Displays. 5314 clock chip, transformer, all components and full instructions. Orange displays also avail. **Same kit w/.80" displays.** Red only **$21.95** Case **$11.75**

8K/16K Eprom Kit (less PROMS)	$89.00
Motherboard	$39.00
Extender Board	$8.99

RESISTORS ¼ watt 5%
10 per type .03 — 1000 per type .012
25 per type .025 — 350 piece pack
100 per type .015 — 5 per type 6.75
½ watt 5% per type .05

KEYBOARDS

56 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	60.00
Fully assembled	70.00
Enclosure	14.95
Metal Enclosure	29.95

LEDS

Red T018	.15
Green, Yellow T018	.20
Jumbo Red	.20
Green, Orange, Yellow Jumbo	.25
Cliplite LED Mounting Clips	8/$1.25

(specify red, amber, green, yellow, clear)

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip.
MAX-100 8 digit Freq. Ctr. $128.95

OK WIRE WRAP TOOLS in stock
Portable Multimeter $18.00

SPECIAL PRODUCTS

MM5865 Stopwatch Timer with 10 pg. spec.	9.00
PC board	7.50
Switches Mom. Pushbutton	.27
3 pos. slide	.25
Encoder HD0165-5	6.95
Paratronics 100A Logic Analyzer Kit	**$224.00**
Model 10 Trigger Expander Kit	$229.00
Model 150 Bus Grabber Kit	$369.00
Sinclair 3½ Digit Multimeter	**$59.95**
Clock Calendar Kit	**$23.95**
2.5 MHz Frequency Counter Kit	**$37.50**
30 MHz Frequency Counter Kit	**$47.75**

TRANSFORMERS

6V 300 ma	3.25
12 Volt 300 ma transformer	1.25
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.50
24V CT 400 ma	3.95
10V 1.2 amp wall plug	4.85
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
12V 3 amp	8.50
10/15 VAC 8/16 VA wall plug	9.75

DISPLAY LEDS

MAN1	CA	270	2.90
MAN3	CC	125	.39
MAN72/74	CA/CA	300	1.00
DL704	CC	300	1.25
DL707/DL707R	CA	300	1.00
DL727/728	CA/CC	500	1.90
DL747/750	CA/CC	600	1.95
DL750	CC	600	1.95
FND359	CC	357	.70
FND500/507	CC/CA	500	1.35
FND503/510	CC/CA	500	.90
FND800/807	CC/CA	800	2.20
3 digit Bubble			.60
4 digit Bubble			.80
DG8 Fluorescent			1.75
DG10 Fluorescent			1.75
5 digit 14 pin display			1.00
10 digit display			1.25
7520 Clairex photocells			.39
TIL311 Hex			9.50
MAN3640	CC	.30	1.10
MAN4610	CA	.40	1.20
MAN4640	CC	.40	1.20
MAN4710	CA	.40	.95
MAN4740	CC	.40	1.20
MAN6640	CC	.56	2.95
MAN6710	CA	.60	1.35
MAN6740	CC	.60	1.35

MA1002A	**8.95**
MA1002E	**8.95**
MA1012A	**8.95**
102P3 transformer	**2.25**

ROCKWELL AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. $375.00. 4K version $450.00. 4K Assembler $85.00, 8K Basic Interpreter $100.00.

Special small power supply for AIM65 assem. in frame **$49.00.** Complete AIM65 in thin briefcase with power supply **$485.00.** Molded plastic enclosure to fit AIM65 plus power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$599.00**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

AIM65/KIM/VIM I/O Expansion Kit; 4 parallel and 2 serial ports plus 2 internal timers **$39.00.** PROM programmer for 2716 **$150.00.**

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12 option. ±5v, ±12v are regulated. Kit $29.95. Kit with punched frame $37.45, $4.00 shipping. Kit of hardware $14.00. Woodgrain case $10.00, $1.50 shipping.

PROM Eraser

Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled **$37.50**
Safety switch/Timer version **$69.50**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

LRC 7000 + Printer $389.00

40/64 column dot matrix impact, std. paper. Interface all personal computers.

Televideo Terminal $845.00

102 key, upper, lowercase, 10 Baud rates 24 x 80 char. microprocessor cont. edit. cap.

Intertube II Terminal $874.00

Super Brain

Floppy Disk Terminal $2895.00

79 IC Update Master Manual $29.95

Complete IC data selector, 2500 pg. master reference guide. Over 50,000 cross references. Free update service through 1979. Domestic postage $3.50. No foreign orders.

S-100 Computer Boards

8K Static RAM Kit	$135.00
16K Static RAM Kit	265.00
24K Static RAM Kit	423.00
32K Static RAM Kit	475.00
16K Dynamic RAM Kit	199.00
32K Dynamic RAM Kit	310.00
64K Dynamic RAM Kit	470.00
Video Interface Kit	**$129.00**

Video Modulator Kit $8.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Digital Temp. Meter Kit $34.00

Indoor and outdoor. Switches back and forth. Beautiful. 50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure −100° to +200°F, tenths of a degree, air or liquid. Beautiful woodgrain case w/bezel **$11.75**

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax. BankAmericard and Master Charge accepted. Shipping charges will be added on charge cards.

FREE: Send for your copy of our NEW 1980 QUEST CATALOG. Include 28¢ stamp.

Circle 252 on inquiry card.

Circle 253 on inquiry card.



11542-1 KNOTT ST.
GARDEN GROVE,
CA 92641
(800) 854-6411
(714) 891-2663

2708's
450NS.
8.50 each
8/$60.00

2716's
450NS
5-VOLT ONLY
$35.00

100 PIN-GOLD
IMSAI CONN.
SOLDERTAIL
$2.75 each
10 for **$2.60** ea.

4116's—200NS.
ADD-ON MEMORY FOR: TRS-80,
APPLE, HEATH, EXIDY, ETC.
8 for **$55.00**
16 for **$110.00**

8251
U-ART
$5.00 each
or
$2 for **$9.50**

REGULATORS

320T-5	.90
320T-12	.80
340T-5	.75
340T-12	.65
78405	5.00

MICROBYTE 16K STATIC RAM BOARD
- S-100 COMPATIBLE
- 4K BANK ADDRESSABLE
- EXTENDED MEMORY MANAGEMENT
- NO DMA RESTRICTIONS
- ASSEMBLED & TESTED
- 4MHZ OPERATION

$250.00 each

MICROBYTE 32K STATIC RAM BOARD
- IEEE/S-100 compatible
- 4K bank addressable to any 4K slot within a 64K boundary
- On board 8-bit output port
- No DMA restrictions
- 4 Hmz operation

LO-PRO SOCKETS

	1-99	100 Up
14 PIN	.11	.10
16 PIN	.12	.11
18 PIN	.16	.14
20 PIN	.24	.22
24 PIN	.31	.29
28 PIN	.35	.31
40 PIN	.42	.39

CENTRONICS PRINTERS
MODEL #703
180 CPS BI-DIRECTIONAL LOGIC SEEKING PRINTER WITH 132 COLUMN CARRIAGES, ELECTRONIC TOP OF FORM, VFU & CENTRONICS STANDARD PARALLEL INTERFACE
$1995.00

LOBO INT'L
SA 800
SINGLE-SIDED/
DBL. DENSITY
SHUGART 8''
FLOPPY DISK
DRIVE, INSTALLED
W/PWR. SUPPLY
(1) DRIVE INSTALLED
$775.00
(2) DRIVES INSTALLED
$1250.00

CATALOG AVAILABLE
CALL OR WRITE

LOBO INT'L.
APPLE II
DISK DRIVE
(1) SHUGART 400
W/CABLE
$395.00
*WITH OPTIONAL
INTERFACE CARD
$495.00

TRS-80 DISK DRIVE
- UP TO 218K BYTES
- SINGLE/DOUBLE DENSITY
- SOFT SECTOR
- 25 MSEC. ACCESS
- SOFTWARE COMPATIBLE
- ASSEMBLED & TESTED

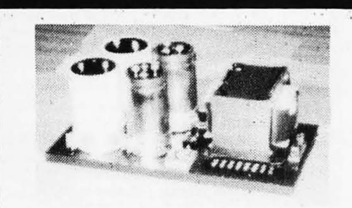
$395.00 each

ORDERING INFO
NAME, ADDRESS, PHONE
SHIP BY: UPS OR MAIL
SHIPPING CHRG. ADD
$2.00 UP TO (5) LBS.

TERMS
WE ACCEPT CASH,
CHECK, MONEY ORDER,
VISA & MASTER CHARGE
CREDIT CARDS.
(U.S. FUNDS ONLY)
TAX: 6% CALIF. RES.

CAPACITORS
.1@12 VOLTS
10¢ each
or
100/$9.00

BUILD YOUR OWN LOW COST MICRO-COMPUTER POWER SUPPLIES
FOR S-100 BUS, FLOPPY DISCS, ETC.



POWER TRANSFORMERS (WITH MOUNTING BRACKETS)

ITEM NO.	USED IN KIT NO.	PRI. WINDING TAPS	SECONDARY WINDING OUTPUTS 2×8 Vac	2×14 Vac	2×24 Vac	SIZE W × D × H	UNIT PRICE
T_1	1	0V, 110V, 120V	2×7.5A	2×2.5A	———	3¾"×3⅝"×3⅛"	21.95
T_2	2	0V, 110V, 120V	2×12.5A	2×3.5A	———	3¾"×4⅜"×3⅛"	27.95
T_3	3	0V, 110V, 120V	2×9A	2×2.5A	2×2.5A	3¾"×4⅜"×3⅛"	29.95
T_4	4	0V, 110V, 120V	2×4A	———	2×3A	3¾"×3⅝"×3⅛"	21.95

POWER SUPPLY KITS (OPEN FRAME WITH BASE PLATE, 3 HRS. ASSY. TIME)

ITEM	USED FOR	@+8 Vdc	@−8 Vdc	@+16 Vdc	@−16 Vdc	@+28 Vdc	SIZE W×D×H	UNIT PRICE
KIT 1	15 CARDS SOURCE	15A	———	2.5A	2.5A	———	12"×6"×4⅞"	51.95
KIT 2	SYSTEM SOURCE	25A	———	3A	3A	———	12"×6"×4⅞"	58.95
KIT 3	DISC SYSTEM	15A	1A	2A	2A	4A	14"×6"×4⅞"	66.95
KIT 4	DISC SOURCE	8A	1A	———	———	5A	10"×6"×4⅞"	49.95

EACH KIT INCLUDES: TRANSFORMER, CAPACITORS, RESIS., BRIDGE RECTIFIERS, FUSE & HOLDER, TERMINAL BLOCK, BASE PLATE, MOUNTING PARTS AND INSTRUCTIONS.

DISC DRIVE POWER SUPPLY "R3" ASSY. & TESTED, OPEN FRAME, SIZE: 9" (W) × 5" (D) × 5" (H) **64.95**

SPECS: +5V @ 5A REGULATED, −5V @ 1A REG., +24V @ 5A REG., SHORTS PROTECT.
IDEAL FOR 2 SHUGART 801/851 OR SIEMANS FDD100-8/200-8 DISK DRIVES & ROCKWELL AIM-65.

SHIPPING FOR EACH TRANSFORMER: $4.75. FOR EACH POWER SUPPLY: $5.00 IN CALIF. $7.00 IN OTHER STATES. CALIF. RESIDENTS ADD 6% SALES TAX. OEM WELCOME.



MAIL ORDER:
P.O. BOX 4296
TORRANCE, CA 90510

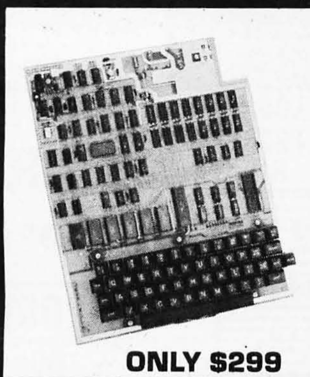
SUNNY INTERNATIONAL
(TRANSFORMERS MANUFACTURER)
Telephone: (213) 633-8327

STORE:
7245 E. ALONDRA BLVD.
PARAMOUNT, CA 90723
STORE HOURS: 9 AM–6 PM



Circle 254 on inquiry card.

Now get OHIO SCIENTIFIC personal computer products with guaranteed, quick, mail order delivery.



ONLY $299

Ohio Scientific Superboard II

The first complete computer system on a board. Includes keyboard, video interface and audio cassette interface. 8K BASIC-in-ROM; 4K RAM. Requires power supply +5V at 3 Amp.

"We heartily recommend Superboard II for the beginner who wants to get into microcomputers with a minimum cost. A real computer with full expandability."
POPULAR ELECTRONICS, MARCH, 1979

"The Superboard II is an excellent choice for the personal computer enthusiast on a budget."
BYTE, MAY, 1979

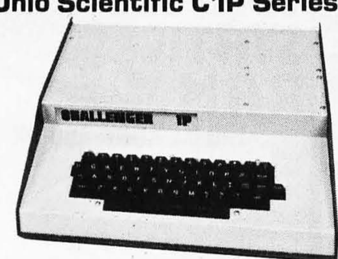
Ohio Scientific C4P Series.



The Challenger 4P. A 4-slot computer with one open slot. Highly sophisticated 16 color video interface. 32 rows x 64 columns, upper and lower case. 8K BASIC-in-ROM, 8K RAM. 200-20KHz programmable tone generator. AC remote interface. Expandable to 32K RAM and two mini-floppy drives. **$750.**

The Challenger 4P MF. Mini-floppy version of the 4P. Two to three times faster than competitors. More I/O built-in than any other in its class. 24K RAM. Real time clock. Modem interface. Printer interface. Foreground/Background operation and much, much more. **$1795.**

Ohio Scientific C1P Series.



The Challenger 1P. The best bargain in personal computer anywhere! 8K BASIC-in-ROM. 4K RAM. Cassette based with 53-key keyboard. B&W video interface, 30 rows x 30 columns. Upper and lower case. 8K RAM **$399.**

Ohio Scientific C1P MF. Mini-floppy version of the C1P. 8K BASIC-in-ROM. **$995.** 20K RAM and OS-65D software. Fully expandable. **$1250.**

Accessories

AC-3P 12″ B/W monitor, TV	$ 125
AC-15P 12″ Color monitor	$ 450
AC-16P 2-8 Axis Joysticks with cable	$ 39
AC-11P Answer/Originate 300 baud modem with cable	$ 199
AC-17P Home Security Starter Set. 1 fire detector, 2 window alarms, 1 door unit.	$ 249
AC-18P 8½″ aluminized paper printer. Upper/lower case.	$ 695
AC-9TP Centronics 799 110cps tractor feed, business printer with interface	$ 1250
AC-12P AC-Remote starter set. Console. 2 lamp modules, 2 appliance modules, OS 65D home control operating system	$ 175
Disk Drives	
CD 3P Single 5″ mini floppy	$ 499
CD 2P Dual 8″ Disk with interface and OS-65D DOS	$ 1599
Power Supplies	
PS 1. 5-volt @ 3 amps regulated. For use with Superboard II	$ 29
Boards (Assembled and tested)	
CM 9P. 24K Static.	$ 399
610. 8K Static. Expandable to 24K and dual mini-floppy controller.	$ 298
CA-14A. Votrax® voice synthesizer.	$ 399
CA-15 Universal Telephone Interface, rotary or touch tone	$ 499
CA-15V UTI with Votrax®	$ 799
CM-6 48K Dynamic memory board.	$ 499
4KP. 4K static RAM chip set	$ 69
CA12. 96 line parallel I/O	$ 175
Books:	
How to Program Microcomputers, By William Barden	$ 8.95
Basic and Personal Computer By Dwyer & Critchfield	$12.95
Howard Sams C1P Service Manual	$ 7.95
Howard Sams C4P Service Manual	$15.95

Ohio Scientific 8P Series.



Challenger 8P. Ohio Scientific's mainframe-class. Personal computer. 8 slots with 6 open. Cassette based with 8K BASIC-in-ROM. 8K static RAM, expandable to 32K RAM, and dual 8-inch floppy disk drive. **$950.**

Challenger 8P DF. A top of the line personal and small business computer. 32K RAM, expandable to 48K. Features dual 8″ floppy disk drives. Audio output 200 20KHz. DAC for voice generation. Keypad interfaces. Joystick (2) interfaces. AC Remote. Real Time Clock. Printer & Modem interfaces. And more. **$2895.**

SOFTWARE

Cassettes

Add Game	$ 6.00
BASIC Tutor Series	$29.00
Torpedo	$ 6.00
Address Book	$ 8.00
Programmable Calculator	$12.00
Savings Account	$ 6.00
Breakout	$ 6.00
Battleship	$ 6.00
Bowling	$ 6.00
Destroyer	$ 6.00
Space War	$ 6.00
Star Trek	$ 6.00
Tiger Tank	$12.00

Disks

When ordering, specify Challenger 1P, 4P or 8P

MDMS Education System	$29.00
MDMS Checking and Savings Account	$29.00
MDMS Personal Calendar/Address Book	$29.00
Home Control II	$29.00
DAC I Music Generation	$39.00
Baseball I & II, Golf, Bowling, Hockey	$39.00
Poker, Black Jack, Spades, Hearts, more	$29.00
Tiger Tank, Space Attack, Etch-A-Sketch, more	$29.00
Star Wars, Zulu 9, High Noon, more	$29.00
Monster, Kite, Three Little Pigs, Humpty Dumpty and more (2 Disk Set)	$29.00

Many, many more software systems are available to you. See our catalog for complete listings.

Freight Policies

All orders of $100 or more are shipped freight prepaid. Orders of less than $100 please add $4.00 to cover shipping costs. Ohio Residents add 5.5% Sales Tax.

Guaranteed Shipment Cleveland Consumer Computers & Components guarantees shipment of computer systems within 48 hours upon receipt of your order. **Our failure to ship within 48 hours entitles you to $35 of software, FREE.**

To Order:

Or to get our free catalog
CALL 1-800-321-5805 TOLL FREE.
Charge your order to your **VISA** or **MASTER CHARGE** ACCOUNT
Ohio Residents Call: (216) 464-8047.
Or write, including your check or money order, to the address listed below.





Hours:
Call Monday thru Friday
8:00 AM to 5:00 PM E.S.T.

CLEVELAND CONSUMER COMPUTERS & COMPONENTS
P.O. Box 46627
Cleveland, Ohio 44146

TO ORDER: CALL
1-800-321-5805
TOLL FREE

Circle 255 on inquiry card.

Circle 256 on inquiry card.

Circle 257 on inquiry card.

Radio Hut **Radio Hut** **Radio Hut** **Radio Hut**

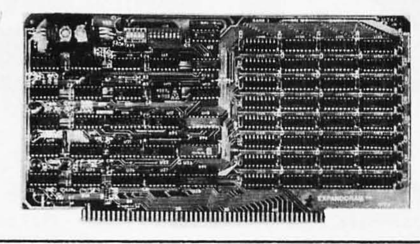
Radio Hut

201 LOCHWOOD MALL • DALLAS, TEXAS 75218
ORDER BY PHONE—214-324-5509

PLEASE WRITE FOR CATALOG
PRICES SUBJECT TO CHANGE
WITHOUT NOTICE

ORDERING INFORMATION & TERMS: Orders under $15.00 add 75¢ handling. No C.O.D. We accept Visa, MasterCharge, and American Express cards. Tex. Res. add 5% tax. Foreign orders (except Canada) add 20% P&H. 90 Day Money Back Guarantee on all items. Add 5% P&H, maximum $5.00.
ORDER BY PHONE — (214) 324-5509

SD EXPANDORAM



The EXPANDORAM is available in versions from 16K up to 64K, so for a minimum investment you can have a memory system that will grow with your needs. This is a dynamic memory with the invisible on-board refresh, and IT WORKS!

- Bank Selectable
- Phantom
- Power 8VDC, +16VDC, 5 Watts
- Lowest Cost Per Bit
- Uses Major Brand 16K RAMS
- PC Board is doubled solder masked and has silk-screened parts layout
- Extensive documentation clearly written
- Complete kit includes all Sockets for 64K
- Memory access time: 375ns, Cycle time: 500ns.
- No wait states required
- 16K boundaries and Protection, via Dip Switches
- Designed to work with Z-80, 8080, 8085 CPU's

EXPANDORAM 64K Kit (16K Ram)

16K	$239.95
32K	309.95
48K	379.95
64K	449.95

SD'S PROM 100 PROM Programmer Board

The PROM-100 Programmer is a development tool for S-100 Bus computer systems. The Zero Insertion Force Programming Socket extends above the card cage height for easy access to PROM devices. Software verifies PROM erasure, verifies program loading and provides for reading of object file from Disk or PROM and programming into PROM/EPROM. Features include: On-board generated 25vdc Programming pulse, TTL compatible, maximum programming time for 16,389 bits is 100 seconds. Programs: 2708, Intel 2758, 2716, 2732 and TI 2516. DIP Selectable EPROM type.

PROM-100 Board Kit $149.95

SD'S SBC-200 SINGLE BOARD COMPUTER Kit $289.95

S-100 Bus compatible and based on the powerful Z80 microprocessor, the SBC-200 meets the needs of a Z-80 CPU board with many additional features. Ideal for Industrial and control applications. All of the same features that have made the SBC-100 famous, PLUS 4MHz OPERATION. • S-100 Bus Compatible • Z80 Central Processing Unit • 1024 Bytes of Random Access Memory • 8K Bytes of PROM using 2716 • Serial Input/Output Port (with Asynchronous and Synchronous Operation) • Parallel Input and Output Ports • Four Channel Counter/Timer (Z80-CTC) • Software Programmable Baud Rate Generator • No-Front Panel Required for Operation • 4 MHz Operation.

SD'S VERSAFLOPPY II

• IBM 3740 Compatible Soft Sectored Format for Single Density Drives • Operates with Single and Dual Sided Drives, Single or Double Density Drives and 5" & 8" Drives — in any combination of four simultaneously • Drive Select and Side Select Circuitry • S-100 Bus Compatible • Vectored Interrupt Operation Optional • Phase Locked Loop Data Recovery Circuit • Operates with Z80 CPU's • Uses FD1791-1 Controller Chip • Ther Versafloppy II incorporates all the possible features of a flexible disk drive controller into one board. Capable of handling four drives simultaneously, combinations of any variety are possible, such as 5" single sided, 8" dual density dual sided, 5" dual density single sided. Most popular drives are controlled directly with the Versafloppy II. The operating system for the Versafloppy II is the extremely powerful SDOS available for SD Systems. Diagnostic and control software available to complete your disk system.

KIT $335.95

SD'S VDB-8024 VIDEO DISPLAY BOARD



The VDB-8024 features its own on-board Z80 microprocessor. This gives the capability of using software (included in ROM) to control functions and enhancements without interference with the computer's CPU. Included in the special features: 80 characters by 24 lines display, keyboard power and interface, composite and separate video output, 2K on-board RAM, a total of 256 available characters, full cursor control, forward and reverse scrolling, underlining, field reverse, field protect enhancements, programmable characters.

KIT $329.95 A&T $389.95

SD'S "VERSAFLOPPY I" KIT

FEATURES: IBM 3740 soft sectored compatible, S-100 BNS Compatible for Z-80 or 8080. Controls up to 4 drives (single or double sided). Directly controls the following drives: Sugart SA400/450 Mini Floppy • Shugart SA800/850 Standard Floppy • PERSCI 70 and 277 • MFE 700/750 • CDC 9404/9406

$189.95

SD'S SBC-100 SINGLE BOARD COMPUTER

The SBC-100 provides a complete micro-computer on a single board! The Z80 microprocessor is used as the heart of the SBC-100. The SBC-100 meets all the requirements of a Z80 CPU board with the added features of I/O ports, counter/timer channels, on board RAM, provisions for PROM/ROM and a software programmable baud rate generator. S-100 Bus compatible, the SBC-100 features are: 8K bytes of available PROM, 1024 bytes on-board RAM, Serial I/O with both synchronous and asynchronous operation, Parallel I/O ports, Operational Vectored Interrupts, and Four Counter/Timer Channels. SD Monitor available for RS-232 and Video Terminals. Disk based system software also available.

SBC-100 KIT $249.95

TARBELL FLOPPY DISK INTERFACE

Compatible with Z80 & 8080. S-100 Bus. Uses CPM operating system. Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate
KIT $190.00 Assembled & Tested $260.00

TARBELL CASSETTE INTERFACE

Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate • Extremely reliable • Phase encoded • 4 extra status & control lines
KIT $99.95

SSM

CB2 Z-80 CPU Board Kit $186.00

Operates at 2 MHZ or 4 MHZ by DIP switch selection and includes two sockets for 2716 or 2732 EPROMs or TMS 4016 2K RAMs. Jumper options generate the new IEEE S-100 signals.



VB3 80 Character Video Board Kit $299.95

• 80 char. per line, up to 51 lines • Graphics up to 160 × 204 matrix • Up to 256 user defined symbols (optional EPROM) • Composite video

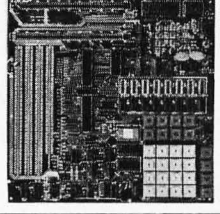
PB1 2708/2716 Programmer & 4K/8K EPROMBoard Kit SSM $124.00

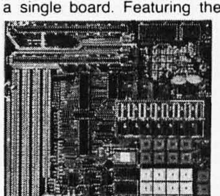
• S-100 bus • 2 separate programming sockets for 2708 or 2716 (5V) EPROMs • Programming voltage generated on board — no need for an external power supply • Software control of 2708/2716 programming selection • LED indicator for programming mode and an on-off switch for programming voltage • 4 sockets for 4K of 2708 or 8K of 2716 EPROMs • Unused EPROM sockets do not enable data bus drive so the board is never committed to the full 4K or 8K of memory • Jumper selectable wait states (0-4) for fast or slow EPROMS

Z80 STARTER KIT

Kit: $279.95 Assembled & Tested $349.95

SD System's Z80 Starter Kit enables the novice to build a complete microcomputer on a single board. Featuring the powerful Z80 microprocessor, the Z80 Starter Kit features • Keyboard and Display • Audio Interface • PROM Programmer • Expansion and Wire Wrap Area • On Board RAM • 4 Channel Counter/Timer • Z-BUG Monitor in PROM • I/O Ports.





NOVATION CAT ACOUSTIC COUPLER/MODEM $189.00

Let your computer communicate with other computers. Bell Systems 103 compatible 300 baud, answer or originate.

SYM-1

Reg. $269.00
NOW $219.00

- KIM-1 Compatible
- 4K ROM Monitor
- 1K Bytes 2114 RAM
- 65K Memory Expansion
- User EPROM 2716

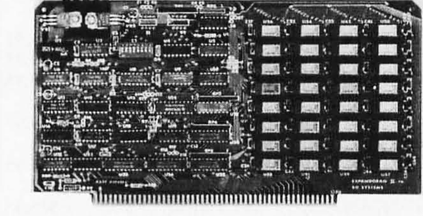
IO4 2 Parallel/2 Serial I/O Board Kit $126.00

• S-100 bus • 2 serial I/O ports (2 in & 2 out) • Independent baud-rate selection from 55 to 9600 baud • Regulated +5V, +12V & −12V outputs provided on both serial headers • 2 latched parallel I/O ports (2 in & 2 out) • Independent DIP switches for setting address • Interrupt capability provided for on serial and parallel I/O ports • +8V @ 0.95A, +16V @ 0.6A, & −16V @ 80mA typical SSM

VB1B VIDEO BOARD KIT $124.00

• S-100 bus • 64 or 32 characters per line (DIP switch selectable), 16 lines • Graphics 128×48 matrix • Upper case, lower case, Greek characters, symbols and numbers • 7×9 dot character matrix • Black-on-white or white-on-black • Timing 60Hz vertical rate, 16.2KHz horizontal rate, Crystal 12.44MHz • Parallel and composite video output (US TV signals), separate video, horizontal and vertical sync SSM

SD'S EXPANDORAM II
The Randem Access Memory



- S-100 Bus Compatible
- Up to 4Mhz Operation
- Expandable Memory from 16K to 256K
- DIP Switch Selectable Boundaries
- Uses 16K (4116) or 64K (4164) Memory Devices
- Page Mode Operation Allows up to 8 Memory Boards on Bus
- Operates with Z80 CPU's
- Phantom Output Disable
- Invisible Refresh (Synchronized with Wait States)

SD Systems' ExpandoRAM II is a dynamic RAM board with capacities from 16K bytes (4116) to 256K bytes (4164). It operates on the industry S-100 Bus. The design allows 8 boards to operate from the same S-100 Bus. The ExpandoRAM II is compatible with most S-100 CPU's based on the Z80 microprocessor.

EXPANDORAM II KIT

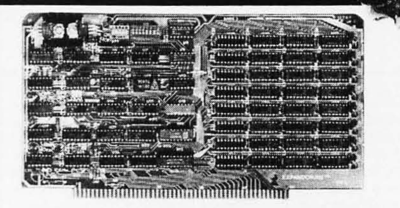
16K	$295.95
32K	369.95
48K	444.95
64K	519.95

Circle 258 on inquiry card.

Radio Hut **Radio Hut** **Radio Hut** **Radio Hut**

JADE. INFLATI FOR THE 80's.

OPENING BOUT



EXPANDORAM
Expandable to 64K Using 4116 RAMS

Interfaces with most popular S-100 boards
Bank selectable; PHANTOM provision
Draws only 5 watts fully populated
Designed to work with Z-80, 8080, and 8085 systems
No wait states required
16K boundaries & protect via dip switches
Kits come with sockets for full 64K
Invisible refresh

MEM-64133K	**64 K KIT**	**$399.95**
MEM-64133A	**A&T**	**$449.95**
MEM-48132K	**48K KIT**	**$334.95**
MEM-48132A	**A&T**	**$384.95**
MEM-32131K	**32K KIT**	**$269.95**
MEM-32131A	**32K A&T**	**$319.95**
MEM-16130K	**16K KIT**	**$204.95**
MEM-16130A	**16K A&T**	**$259.95**

Sale Price $475.00

32K STATIC RAM
Expandable 8K/32K, 2/4MHz, KIT/A&T

Switchable 2 or 4 MHz

THE JADE BIG Z
Z-80A CPU with Serial I/O Port

This CPU can accomodate a 2708, 2716, or 2732 EPROM in SHADOW mode, allowing you to use a full 64K of RAM. The MWRITE signal is generated automatically if you use the board without a front panel. There's also an independent on-board USART to control the RS232 serial port at baud rates from 75 to 19,200.

We've sold thousands of these high quality S-100 CPU boards at $159.95; **but now,** in a brief fit of financial insanity, we're offering them to you for only $135.00! **Don't pass this one up!**

CPU-30201K	(KIT)	**$135.00**
CPU-30201A	(A&T)	**$199.00**
CPU-30200B	(BARE BOARD)	**$35.00**

S D Systems

EXPANDORAM II
4 MHz RAM Board Expandable to 256K

S-100 bus compatible, up to 4 MHz operation
Expandable memory from 16K to 256K
Dip switch selectable boundaries
Page-mode allows up to 8 boards on the same bus
Invisible refresh; PHANTOM output disable
Designed to operate in Z-80 based systems

MEM-64633K	**64K KIT**	**$509.95**
MEM-64633A	**64K A&T**	**$559.95**
MEM-48632K	**48K KIT**	**$439.95**
MEM-48632A	**48K A&T**	**$489.95**
MEM-32630K	**32K KIT**	**$359.95**
MEM-32630A	**32K A&T**	**$409.95**
MEM-16630K	**16K KIT**	**$279.95**
MEM-16630A	**16K A&T**	**$329.95**

Solid State Music

PB-1
EPROM Programmer for 2708 or 2716

MEM-99510K	(KIT)	**$125.00**
MEM-99510A	(A&T)	**$175.00**

JADE DOUBLE-D
Double Density Disk Controller

Read/write single or **double density,** 8" or 5¼" drives
On board Z-80 insures reliable operation
CP/M compatible in either single or double density
Density is software selectable
Up to 4 single or double sided, single or double density drives may be mixed on the same system
EIA level serial printer interface on board-up to 9600 baud (perfect for despooling operations)
All the hard work of disk access is done by the on board Z-80A and 2K memory, leaving your host CPU free for its normal duties
Uses IBM standard formats for proven reliability
THIS BOARD REALLY WORKS!!!!!!

IOD-1200K	(DOUBLE-D KIT)	**$285.00**
IOD-1200A	(DOUBLE-D A&T)	**$349.00**
IOD-1200D	(MANUAL ONLY)	**$15.00**

Terminal Sale

ADDS REGENT
Our Finest Line of Terminals

REGENT 20 $795.00

24 lines X 80 characters, EIA and 20ma current loop interfaces, 110 to 9600 baud, 96 ASCII codes plus 32 control codes, both upper and lower case, 8 X 8 dot matrix, reverse video, auxiliary EIA serial interface, and addressable cursor.

REGENT 25 $850.00

All the features of the Regent 20 plus an 18 key numeric and cursor control pad.

REGENT 40 $1195.00

All the features of the Regent 20 plus a 14 key numeric pad, 8 function keys, 5 cursor control keys, auxiliary port control key, reverse video, underline, blinking, plus full, half, and zero intensities, 8 X 8 dot matrix, 11 special line drawing symbols, reverse scrolling, and send/receive capability using the Regent 40's bi-directional interface.

REGENT 60 $1495.00

All the features of the Regent 40 plus Print Local, Editing, and Transmission Mode keys, business graphics, bar charts, histograms, and graphics, ability to insert or delete characters or lines, buffered mode reduces software needs, and can transmit data at baud rates other than rate received.

Special Package Price

RS-232 SET-$6.50
1 Male DB-25, 1 Female DB-25, 1 Cover

JADE DISKETTES
Magnificent Magnetic Media™

5¼" single sided, single density, box of 10

MMD-5110103	(SOFT SECTOR)	**$29.95**
MMD-5111003	(10 SECTOR)	**$29.95**
MMD-5111603	(16 SECTOR)	**$29.95**

5¼" double sided, double density, box of 10

MMD-5220103	(SOFT SECTOR)	**$39.95**

8" single sided, single density, box of 10

MMD-8110103	(SOFT SECTOR)	**$34.95**

8" single sided, double density, box of 10

MMD-8120103	(SOFT SECTOR)	**$55.95**

8" double sided, double density, box of 10

MMD-8220103	(SOFT SECTOR)	**$57.95**

S D Systems

VERSAFLOPPY
Versatile Floppy Disk Controller

IBM 3740 soft sectored format
S-100 Z-80 or 8080 compatible
Controls up to 4 single or double sided drives
Compatible with all popular disk drives
CP/M compatible
Listings for control software included

IOD-1150K	(KIT)	**$239.00**
IOD-1150A	(A&T)	**$289.00**

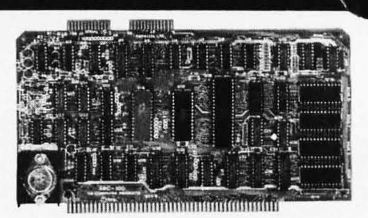
S D Systems

Z-80 STARTER
Complete Z-80 Microcomputer

On-board keyboard, display, EPROM programmer, cassette interface and S-100 interface
Wire-wrap area and room for 2 S-100 connectors
Two 8-bit parallel I/O ports, 4 channel CTC,
5 programmable breakpoints
Examine & change memory, I/O ports, or register

CPS-30010K	**(KIT)**	**$239.95**
CPS-30010A	**(A&T)**	**$299.95**

TITLE MATCH



S D Systems

SBC-100/200
2 or 4 MHz Single Board Computer

S-100 bus compatible Z-80 CPU
1K of on-board RAM
4 EPROM sockets accomodate 2708, 2716, or 2732
One parallel and one serial I/O port
4-channel counter timer chip (Z-80 CTC)
Software programmable serial baud rates

CPC-30100K	**(2 MHz KIT)**	**$239.95**
CPC-30100A	**(2 MHz A&T)**	**$289.95**
CPC-30200K	**(4 MHz KIT)**	**$259.95**
CPC-30200A	**(4 MHz A&T)**	**$309.95**

Coming Soon

NEW JADE P/S I/O
Parallel Serial Interrupt Board

Z-80 SIO, PIO, 2 CTCs, expands to 2 SIOs, 4 CTCs
4 serial ports (async, sync, bisync, SDLC/HDLC)
2 parallel ports **with full handshake**
Software baud rate generators, interval timers, counters, and generates 32 vectored interrupts
Designed especially for MP/M multi-user multi-tasking operating systems. For use with Z-80 only

IOI-1045B	(BARE BOARD)	**$55.00**
IOI-1045K	(KIT)	**$169.95**
IOI-1045A	(A&T)	**$224.95**

Solid State Music

I/O-4
2 Serial & 2 Parallel I/O Ports

IOI-1010K	(KIT)	**$149.95**
IOI-1010A	(A&T)	**$199.95**

ON FIGHTER ROUND #2.

KNOCKOUT PRICES

S D Systems

VERSAFLOPPY II

Double Density Disk Controller

Single or double density floppy disk controller
985600 bytes on 8″ double sided diskettes
259840 bytes on double sided 5¼″ diskettes
S-100 bus (IEEE) standard compatible
IBM 3740 format in single density
8″ and 5¼″ drives controlled simultaneously
Operates with Z-80, 8080, and 8085 CPU's
Controls up to 4 drives
Vectored interrupt operation optional

100-1160K KIT **$299.95**
100-1160A A&T **$349.95**

TKO CHAMPS



ATARI 800

Don't Miss Out on Our Special Sale Price

At last there is a machine designed to give serious competition to Apple and Radio Shack. This computer contains many advanced technical features such as: built in RF modulator for use with a standard TV; 8K of internal RAM (expandable to 48K), 8K BASIC language included; extremely sharp high-resolution color graphics; and built-in peripheral I/O ports. Software is available in plug-in paks and cassette tapes, with many programs available in the areas of entertainment, education, and business/home management.

Available accessories include a printer, disk drives, game controller paddles, and memory expansion cartridges.

And JADE has the Atari 800 **in stock** at a special introductory price.

ATARI 800 .... **$825.00**
810 DISK DRIVE **$575.00**
820 PRINTER **$550.00**
16K RAM EXPANSION KIT **$169.95**
CX30-04 PADDLE CONTROLLER **$19.95**
CX40-04 JOYSTICK CONTROLLER **$19.95**
ATARI 400 .... **$599.95**

We Think It's Superior

SDOS

A New Disk Operating System

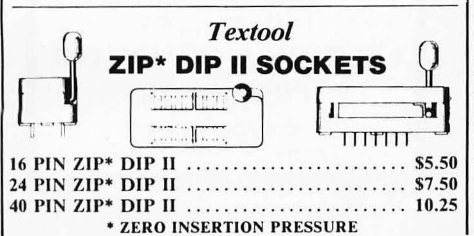
SDOS is a disk operating system which will run any program that runs under CP/M*. It is designed specifically for use with the SBC-100/Versafloppy (I or II) board set by S.D. Systems. SDOS actually has more functions than CP/M, including file attributes, disk label, and read/write logical blocks. It provides additional protection features and is expandable to a multi-user realtime system. And if all that doesn't impress you, SDOS also contains S.D.'s ASSEMBLER/EDITOR/LINKER package and CBASIC 2!

SFX-55001002M (5¼″ W/MAN) **$150.00**
SFX-55001006F (8″ W/MAN) **$150.00**
SFX-55001000D (MANUAL ONLY) .... **$ 15.00**

*CP/M is a trademark of Digital Research

Textool

ZIP* DIP II SOCKETS



16 PIN ZIP* DIP II **$5.50**
24 PIN ZIP* DIP II **$7.50**
40 PIN ZIP* DIP II **10.25**

*** ZERO INSERTION PRESSURE**

COST FIGHTERS

RAMS	
21L02 (2 MHz)	$1.25
21L02 (4 MHz)	$1.50
2114L (2 MHz)	$5.75
2114L (4 MHz)	$5.95
4116 (250ns)	$8.95
4116 (200ns)	$9.50
4127 (70ns)	$39.95
4164 (64K x 1)	$175.00
5257 (2 MHz)	$6.75
5257 (4 MHz)	$7.25
BAUD RATE GENERATORS	
MC14411	$10.00
CRYSTAL	$4.95

SUPPORT DEVICES	
8212	$2.50
8214	$4.65
8216	$2.95
8224	$3.25
8226	$3.85
8228	$4.95
8238	$4.95
8243	$8.00
8250	$14.95
8251	$6.50
8253	$13.95
8255	$6.50
8257	$19.95
8259	$17.95
8275	$49.95
8279	$8.95
3881	$12.95
3882	$12.95
3883	$45.00

6800 SUPPORT	
6821P	$5.95
6828P	$11.95
6834P	$12.95
6840P	$18.75
6850P	$4.80
6852P	$5.79
6875L	$7.40
68488P	$25.00

PROMS	
2708 (450ns)	$8.95
2716 (450ns)	$34.95
2716 (5v)	$34.95
2732 (5v)	$95.00
2758 (5v)	$34.95

MICROPROCESSORS	
Z-80	$10.95
Z-80A	$12.50
6502	$11.50
6800	$11.95
6802	$17.95
6809	$39.95
8035	$24.00
8035-8	$24.00
8080A	$6.59
8085	$15.95
TMS9900JL	$39.95

UARTS	
AY5-1013A	$5.25
AY3-1014A	$8.25
TR1602B	$5.25
TMS6011	$5.95
IM6403	$9.00

Special Package Price

ROCKWELL AIM-65

The Head-Start in Microcomputers

KIM-1 compatible
On-board printer
Full ACSII keyboard
AIM-65 w/1K RAM..$395.00
AIM-65 w/4K RAM..$439.95
8K BASIC ROM..$100.00
POWER SUPPLY..$59.95
CASE for AIM-65..$49.95
4K Assembler/Editor..$85.00

Special Package Price $599.00
4K AIM-65, 8K BASIC ROM, Power Supply, and Case.

JADE
Memory Expansion Kits
FOR

TRS-80 APPLE EXIDY

Everything you need to add 16K of memory to your computer. Your kit comes neatly packaged with easy to follow instructions. In just minutes your computer is ready to tackle more advanced software.

$59.95

Integral Data Systems

THE PAPER TIGER

132 Column Dot Matrix Printer

Up to 198 CPS
1.75 to 9.5 inch adjustable tractor.
Parallel and serial interface.
98 character ASCII set.
80 to 132 columns.
6 or 8 lines per inch.
Eight software selectable character sizes.
110, 300, 600, or 1200 baud.

SPECIAL SALE PRICE

PRM-33440 .... **$950.00**
PRM-33441 (GRAPHICS & 2K BUFFER) . **$1050.00**

CP/M 2.0

Digital Research has done it again! This new release of their industry standard disk operating system is bound to be an even bigger hit than the original version. All of the fundamental file-size restrictions of release 1 have been eliminated, while maintaining full compatability with the earlier versions. This new release can be field-configured by the user for a single mini-disk up through a multiple drive hard-disk system with 128 megabyte capacity. Field configuration can be accomplished easily through use of the Macro Library (DISKDEF) provided with CP/M 2.0.

A powerful operating system for only **$150.00**

Jade's New Motherboards

THE ISO-BUS

6-SLOT

BARE BOARD **$24.95**
KIT **$49.95**
ASSEMBLED & TESTED **$59.95**

12-SLOT

BARE BOARD **$39.95**
KIT **$89.95**
ASSEMBLED & TESTED **$99.95**

18-SLOT

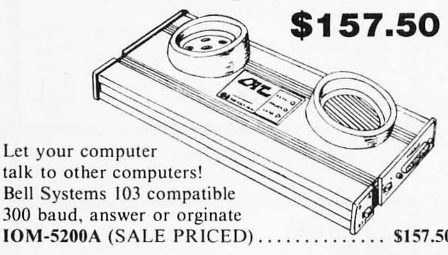
BARE BOARD **$59.95**
KIT **$129.95**
ASSEMBLED & TESTED **$149.95**

Special Price for

NOVATION CAT

Acoustic Coupler/Modem

$157.50



Let your computer talk to other computers!
Bell Systems 103 compatible
300 baud, answer or orginate
IOM-5200A (SALE PRICED) **$157.50**

PLACE ORDERS TOLL FREE

Inside California 800-262-1710
Continental U.S. 800-421-5500

Write for our FREE 1980 catalog

For customer service or technical inquiries call
213-973-7707

TERMS OF SALE: Cash, checks, money orders and credit cards accepted. Minimum order $10.00. California residents add 6% sales tax. Minimum shipping and handling charge $2.50. Prices are for U.S. and Canadian delivery only and are subject to change without notice. For export prices and information send for a **JADE INTERNATIONAL CATALOG.**







JADE
COMPUTER PRODUCTS
4901 W. Rosecrans, Hawthorne, CA 90250

Circle 297 on inquiry card.



COMPUTER EQUIPMENT & SOFTWARE BARGAINS

EVERY MONTH

BUY, SELL OR TRADE ALL TYPES OF COMPUTER EQUIPMENT AND SOFTWARE (pre-owned and new) among 20,000 readers nationwide in BIG (11x14") pages. Classified ads are *only* 10¢ per word and are indexed for *easy* and *fast* location. Subscription: $10 a year/12 issues. Bank cards accepted. Money back guarantee.

COMPUTER SHOPPER
P.O. Box F-14
Titusville, FL 32780
(305) 269-3211

Circle 260 on inquiry card.

MICRO MART

16K UPGRADE KIT FOR TRS-80, APPLE, PET, SORCERER $70
Mostek 4215-3 200ns 16K x 1 RAMS

MICROPOLIS 8" HARD DISK DRIVE with Power, S-100 controller
9 Megabyte $3995
27 Megabyte $4495
45 Megabyte $4995

TI 994 $1050.00

DISCOUNTS on EXIDY SORCERER, PET, most other systems, peripherals, and software.

MICROCOMPUTERS, PERIPHERALS AND SOFTWARE
1015 NAVARRO SAN ANTONIO, TEXAS 78205
512/222 1427

Circle 261 on inquiry card.

MEMOREX Floppy Discs

Lowest prices. **WE WILL NOT BE UNDERSOLD!!** Buy any quantity 1-1000. Visa, Mastercharge accepted. Call free (800)235-4137 for prices and information. All orders sent postage paid.



PACIFIC EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA
93401. (In Cal. call (805) 543-1037.)

Circle 262 on inquiry card.

DISBURSEMENTS & CASH RECEIPTS JOURNALS

In stock & ready to go to work, ready to ship....no waiting

a.) Co-authored, debugged and used by a licensed, practicing CPA.
b.) A copyrighted document balance routine provides for no-fault entries.
c.) As many as 4 Gen. Ledger postings for each document, can all be different.
d.) Document types supported by programs:
DJ-1001 Cash/Checks/Payroll
CJ-2001 Deposits/R.O.A/Credit Memo
e.) Complete audit trails for analysis.
f.) Concise, ready-to-use printouts.
g.) No special training. Programs use live-cueing at every step.
h.) Fully Documented, with listings, & supplied on 5¼" diskette, written in TRS-80 Basic.
i.) Also available in MOD II format.
j.) Total support-for 1-year from date-of-purchase.

DISBURSEMENTS JOURNAL DJ-1001 $95.00
CASH RECEIPTS JOURNAL CJ-2001 $75.00
SPECIAL..BOTH PROGRAMS ONLY $145.00

Complete software packages, and computer supplies at competitive prices.

Checks O.K. — **S & A DATA SYSTEMS**
Master Charge/Visa — P O BOX 39
NO COD's — Craig, CO 81625

NO CHARGE 1-800-854-2003 (ext 804) TOLL
In Calif. 1-800-522-1500 (ext 804) FREE

Circle 263 on inquiry card.

TRS-80 users

Learn FORTH

FORTH is a structured high level language that dramatically cuts program development time. You can expand the FORTH language by defining new operations and data types. FORTH programs are compiled to reduce memory space and speed execution.

tinyFORTH is a complete version of the powerful FORTH language tailored to the TRS-80. The tinyFORTH system includes FORTH, a text editor, an assembler, graphics, and cassette I/O.

Learn FORTH on your own computer. The tinyFORTH user's manual contains hundreds of examples to teach you FORTH in a hands-on style.

tinyFORTH for 16k level II TRS-80:
Cassette and full documentation $29.95
Documentation only .... $ 9.95

All orders are fully guaranteed. And $1.50 for postage and handling. Order with check, money order, Visa, or Mastercharge.

Write for a FREE booklet describing FORTH.

The Software Farm

Box 2304 Dept. A-21 Reston, VA 22090

Circle 264 on inquiry card.

DES-MAR ELECTRONICS
2306 Remo Court
Santa Clara, CA. 95054
(408) 496-0692

BRAND NEW (PLUG IN & RUN)
TRS-80' 16K LEVEL 2
$699.00 DELIVERED

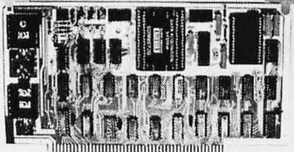
TRS-80 TOTAL COMPATIBLE DISK DRIVES WITH CABLE (JUST PLUG IN & RUN)
$399.00 DELIVERED

***CHECKS OR MONEY ORDERS**
***PRESENT LEAD TIME: 2 WEEKS**
***CA. RESIDENTS 6.5% TAX**

'T.M. OF TANDY CORP.

Circle 265 on inquiry card.

NEW S-100 A/D



- S-100 Bus Compatible A/D Converter
- 12 Bit Accuracy
- 16 Channel Analog Input
- Programmable Gain Amplifier with Sample-and-Hold
- High Quality Commercial/Industrial Construction

2 and 4 Channel, 12 Bit D/A Boards also available.



CALIFORNIA DATA CORPORATION
3475 Old Conejo Road, Suite C10
Newbury Park, California 91320
(805) 498-3651

Circle 266 on inquiry card.

Power Supplies — **5 volts @ 25 amps**

SURPLUS UNITS IN LIKE NEW CONDITION

INPUT: 115 vac 43 - 63 hz
OUTPUT: 5 vdc 0.25 amps
REGULATION: 0.1% + 5 mV
NL-FL. ± 0.1% ± 5mV for 10% Input change
RIPPLE: 2mV RMS max., 20 mV P-P max.
STABILITY: Typically 10 mV for eight hour period

REMOTE SENSING, REMOTE VOLTAGE ADJUSTMENT, OVERLOAD PROTECTION and OVERVOLTAGE PROTECTION
ALSO AVAILABLE IN 12 VDC @ 13 AMPS $79.00 per unit

79.ºº per unit

HOUSE MARKED DARLINGTON TRANSISTOR
SPECIFY NPN or PNP — 5 AMPS 65 WATTS, 80 VOLTS, SIMILAR TO TIP 121NPN, TIP 126 PNP, TO220
75¢ each

22/44 EDGEBOARD CONNECTOR
TIN SOLDERTAIL .156" x .200"
LARGE QUANTITIES AVAILABLE
$1.35 each — 10 for $12.50

1½ AMP FULL WAVE BRIDGE RECTIFIER
400 PIV
2 for $1.00

REED RELAYS
9-15 VOLT D.C. LATCH
NORMALLY OPENED
CONTACTS:
1 amp max. switch
2 amp max. carry
BODY SIZE:
approx. 1 inch long
¼ inch high

S.P.S.T. 1500 ohm coil $1.15 each
D.P.S.T. 1200 ohm coil $1.30 each
3.P.S.T 750 ohm coil $1.50 each

ALL ELECTRONICS CORP.
905 S. Vermont Ave. • Los Angeles, Calif. 90006
DEPT. BY-1 (213) 380-8000

STORE & WAREHOUSE HOURS
Mon. - Fri. 9 AM - 5 PM
Saturday 10 AM - 3 PM

TERMS
• Quantities Limited
• Min. Order $10.00
• Add $1.50 Shipping USA
• Calif. Res. Add 6%
• Prompt Shipping

SEND FOR OUR FREE CATALOG

Circle 267 on inquiry card.

DISCOUNT PRICES

NORTH STAR
APPLE II
MICROTEK
ANADEX
TRENDCOM
CENTRONICS
SOROC
INTERTUBE
THINKER TOYS
SOLID STATE MUSIC
& OTHERS

Call for Prices
(301) 694-8884

FREDERICK COMPUTER PRODUCTS
Municipal Airport
Frederick, MD. 21701

Circle 268 on inquiry card.

UP TO 25% OFF

IMMEDIATE DELIVERY: Why wait 5 months for hardware from other suppliers—get it quicker—and at lower prices NOW.



TRS 80 MODEL II — **$3899.00**

- 64 K RAM
- ½ MEG DISK

FIRST EXPANSION DRIVE	899.00
SECOND OR THIRD DRIVE	600.00
LINE PRINTER III Reg. $1999.00	NOW $1859.00

TRS 80 MODEL I

	LIST PRICE	OUR PRICE
4 K LEVEL I SYSTEM	$499.00	$464.10
4 K LEVEL II SYSTEM	$619.00	$575.70
16 K LEVEL II SYSTEM	$849.00	$789.60
EXPANSION INTERFACE (O K Memory)	$299.00	$278.10
TELEPHONE MODEM	$199.00	$185.10

	LIST PRICE	OUR PRICE
CENTRONICS 730	$995.00	$695.00
CENTRONICS 737 • 100 CPS • LETTER QUALITY DOT MATRIX • TRUE DESCENDERS		$950.00
NEC SPINWRITER 5530 (with Tractors)	3195.00	2950.00

YOUR OWN TRS-80 SYSTEM AT TREMENDOUS SAVINGS

MAY SPECIAL
Good Until May 31, 1980

MINI DISK DRIVES NOW $350

Over $135 less than Radio Shack's!

WE ARE COMMITTED TO THE TRS-80 and THE TRS-80 USERS
Fully compatible with Radio Shack's operating system TRSDOS™ and drives. Just plug in and run!

- One, two, three or four drive configurations, 102k to 408k bytes.
- All systems include a patch program to upgrade your TRSDOS™ to 40 tracks.
- Cases are furnished in gray to match your system.

IMMEDIATE DELIVERY: Why wait 5 months for mini disk drives from other suppliers—get better drives-quicker-and at lower prices now!

ORDER NOW TOLL FREE 800-345-8102

ORDER NOW TOLL FREE 1 - (800) - 345-8102

NEW! FOR MODEL II

10—MEG FIXED/REMOVEABLE HARD DISK DRIVE WITH SOFTWARE AND CONTROLLER ONLY $6495.00

***NEW!* THE SOURCE**

A new information and communication network to add power and utility to your micro.
Call or Write for details.

BUSINESS SOFTWARE

	Model I	Model II
Payroll	$99.00	199.00
GENERAL LEDGER	149.00	199.00
DATA BASE MANAGEMENT SYSTEM	149.00	249.00

NOW OPEN V R DATA'S Computer Repair Center

VR Data corp. *MORE DATA PER DOLLAR*

777 Henderson Boulevard N-6 • Folcroft Industrial Park • Folcroft, PA 19032 • (215) 461-5300

master charge · VISA

FOREIGN and DOMESTIC DISTRIBUTORSHIPS AVAILABLE • TOLL FREE 1 - (800) 345-8102 Orders only!

BECKIAN ENTERPRISES

ALL PRIME QUALITY — NEW PARTS ONLY
SATISFACTION GUARANTEED.

EDGE CARD CONNECTORS: GOLD PLATED:

Abbreviations: S/E Solder Eye . S/T Sold Tail: W/W Wire Wrap.

PART #	DESCRIPTION.	Row Sp.	1-9pc.	10-24pcs.	25pcs. Up.
BRAND: TEXAS INST.					
4070	50/100 Imsai/Crom.	.250	$3.95ea.	$3.55ea.	$3.15ea.
4090	50/100 Imsai W/W	.250	4.30ea.	3.85ea.	3.45ea.
BRAND: SULLINS: U.L Reg.					
129865	50/100 Solder Eye	.140	6.80ea.	6.10ea.	5.45ea.
129870	50/100 S/T Imsai	.250	4.50ea.	4.10ea.	3.70
129875	50/100 W/W Imsai	.250	5.25	4.75	4.20
129885	50/100 S/T Altair	.140	4.95	4.45	3.95
129990	50/100 S/T Cromem.	.250	4.75	4.25	3.80
OTHER .125" CONTACT CTR CONNECTORS:					
12305	22/44 S/E No Ears	.140	4.15	3.75	3.35
12759	36/72 S/T	.140	5.40	4.85	4.35
12790	40/80 W/W	.250	6.30	5.65	5.00
.100" CONTACT CTR CONNECTORS:					
10048	13/26 S/E No Ears	.140	3.40	3.05	2.15
10280	25/50 S/E TRS 80	.140	4.50	4.05	3.60
10175	20/40 S/E TRS 80	.140	5.85	5.35	4.75
10180	20/40 W/W TRS 80	.200	3.30	3.00	2.15
10190	20/40 S/T TRS 80	.140	3.20	2.90	2.55
10485	36/72 S/E Vector	.140	5.50	4.90	4.40
10490	36/72 W/E Vector	.200	5.80	5.25	4.65
10500	36/72 S/T Vector	.140	5.70	4.20	4.60
10535	40/80 S/E PET	.140	5.85	5.35	4.75
10540	40/80 W/W PET	.200	6.00	5.40	4.80
10550	40/80 S/T PET	.140	5.80	5.25	4.65
10585	43/86 S/E COS/ELF	.140	6.95	6.25	5.55
10605	43/86 S/T COS/ELF	.140	6.60	5.95	5.30
10595	43/86 W/W COS/ELF	.200	6.90	6.20	5.95
10615	43/86 S/T COS/ELF	.200	6.80	6.10	5.40

.156" CONTACT CENTER CONNECTORS.

PART #	DESCRIPTION.	Row Sp.	1-9pc.	10-24pcs.	25pcs. Up.
15105	6/12 S/E PET/NSC	.140	$1.80	$1.65	$1.45
15110	6/12 S/T PET/NSC	.140	1.85	1.65	1.50
15137	6/12 S/T PET/NSC	.200	1.80	1.54	1.45
15175	6/- S/E Sgle Row	- -	1.70	1.50	1.30
15270	10/20 S/E	.140	2.15	1.95	1.70
15275	10/20 S/T	.140	2.00	1.85	1.60
15435	12/24 S/E PET	.140	2.60	2.35	2.10
15440	12/24 S/T PET	.140	2.65	2.40	2.15
15445	12/24 S/T PET	.200	2.75	2.50	2.20
15505	15/30 S/E GRI Key	.140	2.50	2.25	2.00
15510	15/30 S/T GRI Key	.140	2.40	2.15	2.95
15515	15/30 W/W GRI Key	.200	2.60	2.35	2.10
15600	18/36 S/E	.140	3.35	3.05	2.70
15610	18/36 S/T	.140	3.00	2.70	2.40
15615	18/36 W/W	.200	3.60	3.20	2.90
15700	22/44 S/E KIM/VEC	.140	2.98	2.90	2.75
15705	22/44 S/T KIM/VEC	.140	3.98	3.30	3.00
15710	22/44 W/W KIM/VEC	.200	3.49	3.20	2.85
15875	25/50 S/E	.140	4.65	4.20	3.75
15880	25/50 S/T	.140	4.55	4.10	3.65
15885	25/50 W/W	.200	4.85	4.35	3.90
16115	36/72 S/E	.140	6.50	5.85	5.20
16120	36/72 S/T	.140	6.55	5.90	5.25
16125	36/72 W/W	.200	6.75	6.10	5.40
16145	36/72 S/T	.200	6.50	5.85	5.20
16235	43/86 S/T Mot 6800	.140	6.60	5.95	5.30
16240	43/86 W/W Mot 6800	.200	7.80	7.05	6.25
16260	43/86 S/T Mot 6800	.200	6.50	5.85	5.20
16725	43/86 S/E Mot 6800	.140	7.20	6.50	5.75
K-1	Pol-Keys		.15	.12	.10

'D' TYPE SUBMINIATURE CONNECTORS.

PART NUMBER		DESCRIPTION.	1-9pcs.	QUANTITY 10-24pcs.	25-99pcs.
DE	9P	Male	$1.60ea.	$1.40ea.	$1.30ea.
DE	9S	Female	2.25ea.	2.00ea.	1.90ea.
DE	110963-1	2 pc. Grey Hood.	1.50ea.	1.35ea.	1.20ea.
DA	15P	Male	2.35ea.	2.15ea.	2.00ea.
DA	15S	Female	3.25ea.	3.10ea.	2.90ea.
DA	51211-1	1. pc. Grey Hood	1.40ea.	1.20ea.	1.15ea.
DA	51226-1	2 pc. Black Hood	2.50ea.	2.25ea.	2.00ea.
DA	110963-2	2 pc. Grey Hood	1.60ea.	1.35ea.	1.30ea.
DB	25P	Male	2.80ea.	2.60ea.	2.40ea.
DB	25S	Female	3.60ea.	3.40ea.	3.20ea.
DB	51212-1	1 pc. Grey Hood	1.50ea.	1.30ea.	1.10ea.
DB	51226-1	2 pc. Black Hood	1.90ea.	1.65ea.	1.45ea.
DB	110963-3	2 pc. Grey Hood	1.75ea.	1.50ea.	1.35ea.
DC	37P	Male	4.20ea.	4.00ea.	3.70ea.
DC	37S	Female	6.00ea.	5.75ea.	5.50ea.
DC	110963-4	2 pc. Grey Hood	2.25ea.	2.00ea.	1.75ea.
DD	50P	Male	5.50ea.	5.10ea.	4.75ea.
DD	50S	Female	9.40ea.	8.60ea.	8.00ea.
DD	51216-1	1 pc. Grey Hood	2.40ea.	2.20ea.	2. 00ea.
DD	110963-5	2 pc. Grey Hood	2.60ea.	2.40ea.	2.10ea.
D	20418-2	Hardware Set (1 Hood Set)	.90ea.	.80ea.	.70ea.

I.C. SOCKETS GOLD. W/WRAP 3 TURN

14 pin	$0.40 ea.
16 pin	0.44 ea.

8080A PRIME.
$5.00 ea.

EIA 8 CONDUCTOR CABLES 8ft. Long. CLASS #1 Type Cables.

1. to 4 pcs.	$22.00
5 to 9 pcs.	19.00

I.C. SOCKETS TIN.

14 pin	$0.15 ea.
16 pin	0.17 ea.

CONNECTORS FOR CENTRONICS 700 SERIES.
Amphenol 57-30360

1 to 4 pcs.	$8.00 ea.
5 to 9 pcs.	6.00 ea.

COOLING FANS.
Extra Quiet.

1 to 4	$18.00 ea.
5 to 9	17.00 ea.

PHONE: 213-988-6196

TERMS: MINIMUM ORDER: $15.00 ADD $1.35 For Handling & Shipping. Orders over $30.00 in the U.S.A. We Pay the Shipping. CALIF. RESIDENTS: Please Add 6% Sales Tax.

NOTE: NO C.O.D. OR CREDIT CARD ORDERS WILL BE ACCEPTED.

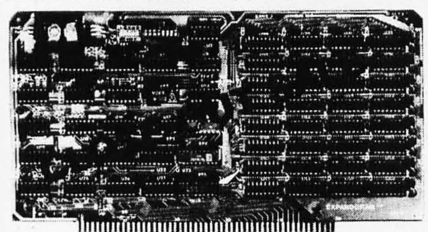
MAIL ORDERS TO:

BECKIAN ENTERPRIES
P.O. BOX #3089
SIMI VALLEY, CA 93063



Look to QT for the BIG +

S D SYSTEMS
EXPANDORAM ST
EXPANDABLE TO 64K USING 4116 RAMS



Interfaces with most popular S-100 boards
Bank selectable; PHANTOM provision
Draws only 5 watts fully populated
Designed to work with Z-80, 8080, and 8085 systems
No wait states required
16K boundaries & protect via dip switches
Kits come with sockets for full 64K
Invisible refresh

MEM-16K (16K KIT)	**$239.95**
MEM-16AT (16K A&T)	**$289.95**
MEM-32K (32K KIT)	**$309.95**
MEM-32AT (32K A&T)	**$359.95**
MEM-48K (48K KIT)	**$379.95**
MEM-48AT (48K A&T)	**$429.95**
MEM-64K (64K KIT)	**$449.95**
MEM-64AT (64K A&T)	**$499.95**

SPECIAL
NOVATION CAT
ACOUSTIC COUPLER/MODEM

$157.50

Let your computer talk to other computers !
Bell Systems 103 compatible
300 baud, answer or orginate

QT SYSTEMS FURNITURE +

DS4830 48"w X 30"d X 26"h Pecan or white finish avail	**$149.95**
DS4830-1 48"w X 30"d X 26"h with Micro-Shelf, Pecan finish	**$224.95**
DS4830-2 48"w X 30"d X 26"h with Return, Pecan or white finish avail	**$249.95**
DS-810 Printer Stand for TI 810	**$120.00**

EPROMS

1702A	**$ 4.95**
2708	**$ 6.75**
2516	**$24.00**
2716 (TI)	**$24.00**
2716 (5 VOLT)	**$24.00**
2758	**$27.00**
2532	**$70.00**
2732	**$70.00**

NEW DISK OPERATING SYSTEM
SDOS

SDOS is a CP/M compatible operating system designed for the S D Sales Versafloppy I or II. It requires the SBC-100/Versafloppy board set and functions as a superset of CP/M giving 19 additional functions including the attributes, disk label and read/write logical blocks. It provides additional protection features and is expandable to a multi-user real time system. **$200.00**

TI PRINTERS

TI810 PARALLEL	**$1895.00**
TI810 SERIAL	**$1695.00**

TEXTOOL
ZIP* DIP II SOCKETS

16 PIN ZIP* DIP II	**$5.50**
24 PIN ZIP* DIP II	**$7.50**
40 PIN ZIP* DIP II	**10.25**

* ZERO INSERTION PRESSURE

CP/M 2.0

Digital Research has done it again! This new release of their industry standard disk operating system is bound to be an even bigger hit than the original version. All of the fundamental file-size restrictions of release 1 have been eliminated, while maintaining full compatibility with the earlier versions. This new release can be field-configured by the user for a single mini-disk up through a multiple drive hard-disk system with 128 megabyte capacity. Field configuration can be accomplished easily through use of the Macro Library (DISKDEF) provided with CP/M 2.0.

A powerful operating system for only ... $150.00

5¼" DISK DRIVES

MPI B-51	**$295.00**
SHUGART SA400	**$295.00**
SHUGART 8" 801R	**$495.00**
REMEX RFD 4000	**$595.00**

HARD DISK

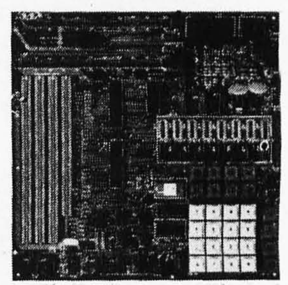
LOBO 10 MEGABYTE For Apple with controller	**$4295.00**
LOBO 10 MEGABYTE For S-100 with controller	**$4795.00**

QT DISKETTES

SOFT SECTOR
5¼" single sided, single density box of 10 .... **$29.95**

SOFT SECTOR
8" single sided, single density box of 10 .... **$34.95**

S D SYSTEMS
Z-80 STARTER KIT
COMPLETE Z-80 MICROCOMPUTER

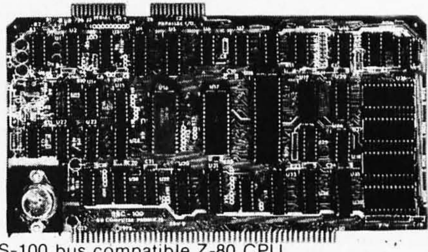


On-board keyboard, display, EPROM programmer, and cassette interface
On-board S-100 interface
Wire-wrap area and room for 2 S-100 connectors
Two 8-bit parallel I/O ports, 4-channel CTC, 5 programmable breakpoints
Examine and change memory, I/O ports, or register

Z-80K (KIT)	**$279.95**
Z-80AT (A&T)	**$349.95**

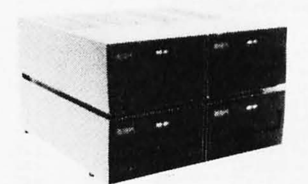
BEST BUY RATED
TV-1 ONLY $7.95
OUR BEST SELLING R.F. MODULATOR

S D SYSTEMS
SBC-100/200
OR 4 MHz SINGLE BOARD COMPUTER



S-100 bus compatible Z-80 CPU
1K of on-board RAM
4 EPROM sockets accomodates 2708, 2716, or 2732
One parallel and one serial I/O port
4-channel counter timer chip (Z-80 CTC)
Software programmable serial baud rates

SBC-100K (2 MHz KIT)	**$249.95**
SBC-100AT (2 MHz A&T)	**$299.95**
SBC-200K (4 MHz KIT)	**$289.95**
SBC-200AT (4 MHz A&T)	**$339.95**



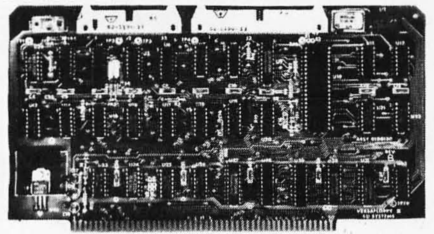
TRS-80 DISK DRIVE (CABLES INCLUDED)

TRS-80 I (5¼")	**$395.00**
TRS-80 II (8")	**$1095.00**
APPLE II	**$1550.00**

DISK DRIVE SYSTEMS
S-100

MS-800-1 (Drive with cables & power supply)	**$1095.00**
MS-800-2 (2 Drives with cables & power supply)	**$1595.00**

S D SYSTEMS
VERSAFLOPPY II
DOUBLE DENSITY DISK CONTROLLER

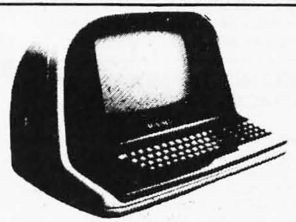


Single or double density floppy disk controller
985600 bytes on 8" double sided diskettes
259840 bytes on double sided 5¼" diskettes
S-100 bus (IEEE) standard compatible
IBM 3740 format in single density
8" and 5¼" drives controlled simultaneously
Operates with Z-80, 8080, and 8085 CPU's
Controls up to 4 drives
Vectored interrupt operation optional

VF-2K (KIT) **$335.95**
VF-2AT (A&T) **$385.95**

APPLE PRODUCTS
APPLE KITS & ASSEMBLED BOARDS

AIO Apple Serial/Parallel Interface
Kit **$115.00**
Assembled and Tested **$155.00**
MICRO-MODEM II **$350.00**
WIZARD CONTROLLER for 8" Disk Drive **$360.00**
SORRENTO CONTROLLER for 8" Apple Disk Drive **$360.00**
INTROL X-10 SYSTEM (turns appliances on/off) **$275.00**
MICRO-MUSIC (Software) **$180.00**
AIO/Serial-Parallel Board Kit **$115.00**
AIO/Serial-Parallel Board A&T **$155.00**
INTEGER Firmware Card **$179.00**
PARALLEL INTERFACE CARD **$90.00**
VISICALC(Business Software Package) **$124.95**
SUPER-MOD II (connects Apple to TV) . **$25.00**
ROM WRITER (Epromburner) Mountain Hardware (order) **$175.00**
PROGRAMMER AID #1 .... **$50.00**
APPLE CLOCK **$280.00**
SANYO 15" MONITOR **$295.00**



MODEL 920 TELEVIDEO
SMART (CRT) TERMINAL

- Reverse Video
- Blinking/blank fields
- Upper/lower case character
- Protected fields
- Non-glare screen
- Underlining
- 12x10 character res.
- Function/editing keys
- Blinking cursor
- Typewriter/TTV keyboards
- Numeric pad
- 9 Baud rates (75-9600 Baud)
- Self-test
- Auxiliary port

SALE PRICE $895.00
Freight charge **$20.00**

QT MEMORY EXPANSION KITS
FOR
TRS-80 APPLE EXIDY
4116-200 ns

Expansion Kit .... **$60.00 ea.**
100 pcs .... **$5.95 ea.**
1,000 pcs .... **$5.25 ea.**

MICROPROCESSORS

Z80 (2 MHz)	$10.95
Z80A (4 MHz)	$12.95
6502	$11.25
6800	$12.50
6802	$19.50
8035	$20.00
8035-8	$20.00
8080A	$ 3.95
8085A	$20.00
8086-4	$60.00
8748-8	$70.00

8080A SUPPORT

8212	$ 4.50
8214	$ 4.50
8216	$ 2.95
8224	$ 4.00
8238	$ 6.00
8243	$ 5.00
8251	$ 7.00
8253	$19.00
8255	$ 6.25
8257	$17.95
8259	$19.95
8275	$69.95
8279	$17.50
8295	$16.50

STATIC RAMS

21L02 (450 ns)	
	64 ea./$1.20 ea.
	100 ea./$1.10 ea.
	1,000 ea./$.95 ea.
2102-1	$1.35
2114L (450 ns)	$5.25 ea.
	100 ea./$4.75 ea.
2114L (300 ns)	$5.50 ea.
	100 ea./$4.50 ea.

UARTS

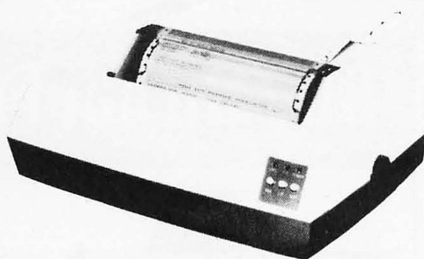
TR1602B	$ 3.75

BAUD RATE GENERATOR

MC14411P	$10.00

CHARACTER GENERATORS

2513 (Upper case)	$10.95
2513 (Lower case)	$10.95
2513 Upper (5 v)	$ 9.75
2513 Lower (5 v)	$10.95
2516 (Sig)	$13.00
6571	$13.00
6571AP	$10.95



MATCHLESS PRINTERS

FEATURES:
- **Documentation included**
- **132 columns, 63 lines per minute, Bi-Directional, Nominal Thruput**
- **High Reliability - Heavy Duty Cycle, 100 Million Characters Print Head Life**
- **Sprocket Feed**
- **9x7 Dot Matrix Character Front**

SALE PRICE WITH CABLE
FOR **TRS-80 I** **$795.00**
FOR **TRS-80 II** **$795.00**
FOR **APPLE** ****$849.00**
FOR **S-100** **$795.00**
**Includes parallel interface with documentation.
Add freight **$20.00**

SSM PRODUCTS

S-100 BARE BOARDS

CB1A 8080 CPU **$30.95**
VB1B Memory Mapped Video Interface .. **$26.95**
VB2 I/O Mapped Video Interface **$29.95**
I02 Parallel I/O Interface **$34.00**
I04 2P + 2S I/O Interface **$26.95**
SB1 Music Synthesizer **$39.95**
OB1 Vector Jump & Prototyping Board .. **$29.95**
MB6B 8K Static RAM **$25.95**
MB7 Low Power 16K Static RAM **$26.95**
MB8 4K 1702 EPROM Board **$29.95**
MB8A 16K 2708 EPROM Board **$34.95**
T1 Terminator **$26.00**
MTI 15 Slot Motherboard **$45.00**
XB1 Extender Board **$13.50**

SSM SOFTWARE, FIRMWARE, MANUALS, MISC.

SMM 8080 Monitor (on two 2708s or eight 1702s) **$50.00**
AIO Apple Parallel Interface Firmware ... **$25.00**
AIO Apple Pascal Patcher Disk **$25.00**
SB1 Music Synthesizer Software
Paper Tape of MUS-X1 Interpreter .... **$ 9.00**
CP/M Compatible 8" Disk, containing
- MUS-X1 Music Interpreter
- Test Program
- 18 Encoded Music Selections **$25.00**

SB1 Booklet (with 21 Encoded Music Selections) **$10.00**
Manuals
SB1 Music Synthesizer Manual **$10.00**
All Other Manuals .... **$ 5.00**
100 Pin edge connector (short st) .... **$ 3.00**
100 Pin edge connector (standard ww) .. **$ 4.00**
Card Guides .... **$ .15**

S-100 KITS & ASSEMBLED BOARDS

CB1A 8080 CPU
Kit **$129.95**
Assembled & Tested **$189.95**
CB2 Z-80 CPU
Kit **$185.95**
Assembled & Tested **$250.00**
VB1B Memory Mapped Video Interface
Kit **$125.00**
Assembled & Tested **$180.00**
VB2 I/O Mapped Video Interface
Kit **$150.00**
Assembled & Tested **$195.00**
VB3 80 Character Video Interface
80x24 Display, 2 MHz
Kit **$299.95**
Assembled & Tested **$389.95**
80x24 Display, 4 MHz
Kit **$324.95**
Assembled & Tested **$410.00**
Upgrade Kit for 80x51 Display
2 MHz .... **$ 69.00**
4 MHz .... **$ 89.00**
IO2 Parallel I/O Interface
Kit .... **$ 59.00**
Assembled & Tested .... **$ 89.00**
IO4 2P + 2S I/O Interface
Kit **$126.00**
Assembled & Tested **$199.95**
SB1 Music Synthesizer (4)
Kit **$199.00**
Assembled & Tested **$279.00**
OB1 Vector Jump & Prototyping Board
Kit .... **$ 55.00**
Assembled & Tested .... **$ 85.00**
MB6B 8K Static RAM
450 ns RAM
Kit **$129.95**
Assembled & Tested **$149.95**
250 ns RAM
Kit **$159.95**
Assembled & Tested **$224.95**
MB7 Low Power 16K Static RAM
Kit **$269.96**
Assembled & Tested **$375.00**
PB1 2708/2716 EPROM Programmer
Kit with Textool sockets **$129.95**
Assembled & Tested with Textool sockets **$175.00**
MB3 4K 1702 EPROM Board
Kit - without EPROMs .... **$ 65.00**
Assembled & Tested **$125.00**
MB8A 16K 2708 EPROM Board
Kit - without EPROMs
Assembled & Tested
T1 Active Terminator
Kit .... **$ 34.00**
Assembled & Tested .... **$ 64.00**
MT1 15 Slot Motherboard
Kit (with Connectors) **$129.95**
Assembled & Tested **$149.95**
XB1 Extender Board
Kit (with Connector) .... **$ 19.95**
Assembled & Tested .... **$ 29.95**

Circle 272 on inquiry card.



COMPUTER SYSTEMS INC.
15335 South Hawthorne Boulevard
Lawndale, California 90260
(213) 970-0952

PLACE ORDERS TOLL FREE
1-800-421-5150
(CONTINENTAL U.S. ONLY)





Circle 273 on inquiry card.

10-DAY FREE TRIAL

SEND FOR OUR FREE CATALOG

Lear Siegler Terminals & Printers at Tremendous Savings



ADM-3A. Industries' favorite dumb terminal for some very smart reasons. 12" diagonal screen • Full or half duplex operation at 11 selectable data rates • 1,920 easy-to-read characters in 24 rows of 80 letters • RS-232C interface extension port • Direct cursor addressing. Reg. Price. $895 .... **Sale! CALL**

ADM-31. A terminal that's too smart to be considered dumb. Comes complete with keyboard, control logic, character generator, refresh memory & interface • Displays two pages of text instead of one • Field protect mode • Factory installed selected parameters. Reg. Price. $1,450 .... **Sale! CALL**

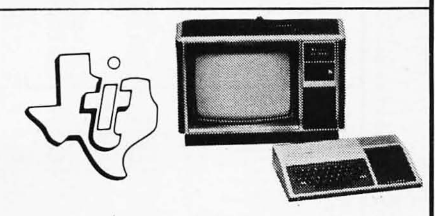
ADM-42 with Keyboard. Reg. Price. $1,795 **Sale! CALL**
ADM-42 without keyboard. Reg. Price. $1,595 .... **Sale! CALL**

Model 310 Ballistic Printer (Serial/Parallel) Reg. Price. $2,045 .... **Sale CALL**

300 Series Ballistic Printers. This application-oriented matrix printer is built to last. Features include: Ballistic Printing • Positive 180 cps • Bi-directional Printing • A character buffer that is optionally expandable to 2,048 characters • 512 character buffer standard.

ADM-42. The semi-intelligent terminal that provides you with flexibility of format, security, editing, interface, and transmission. Two-page display standard (Optionally expandable to eight) • Blanking, blinking, and reverse fields • Three ways to TAB • 16 Function keys do the work of 32 • Detachable keyboard.

We Stock Lear Siegler Accessories — Call For Details.



The remarkable TI-99/4 Home Computer. Compare it. Dollar for dollar. Feature for feature.

Superior color, music, sound & graphics - and a powerful extended BASIC - all built in. Plus a uniqe new Solid State Speech™ Synthesizer and TI's special Solid State Software.™

Comes complete with the Features you want:

- **Powerful TI-BASIC**
- **Up to 72K total memory capability - 16K RAM, 26K ROM plus up to 30K ROM in TI's Solid State Software Command Modules.**
- **16 - color graphics capability**
- **Music & sound effects**
- **Built-in equation calculator**
- **High quality 13" color monitor**

Call our Sales Dept. for Complete Description & Specs.

TI-99/4 Home Computer w/Monitor	$1,050.
TI-99/4 Home Computer w/o Monitor	$8.95.
TI User Reference Manual	$9.95.

TI CALCULATORS - Three of the finest from the first.

TI Programmable 59	$245.00
TI-58C Programmable Calculator (w/continuous memory)	$104.00
TI Programmer	$59.00

Add convenient versatile printing capabilities to your TI Programmable 58C or 59 calculator with the PC-100C thermal printer, plotter.

TI PC-100C 168.00

TI Talking Translator. The translator that actually speaks! $300.00 Language Modules for the TI Translator $49.95 Ea. Available in : Spanish, French, English & German.

SPEAK & SPELL™ - TI's remarkable learning aid with electronic voice & brain. &69.95 Modules for Speak & Spell $17.95 Ea: Super Stumpers (grades 4-6), Vowel Power (Ages 7 & up), Super Stumpers (Grades 7 & 8)

ADDITIONAL TI-99/4 ACCESSORIES

Speech Editor	$99.95
Demonstration	$69.95
Diagnostic	$29.95
Joysticks	$29.95
Speech Box	$149.95
Dual Cassette Cable	$19.95
Math Dictionary	$29.95
Beginners Basic	$9.95

SOLID STATE SOFTWARE COMMAND MODULES

Entertainment:

• Football	$29.95
• Video Chess	$69.95
• Video Graphs	$19.95

Home Management/Personal Finance:

• Home Financial Decisions	$22.95
• Household Budget Mgt.	$44.95

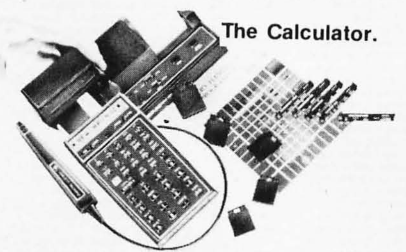
Education:

• Early Learning	$29.95
• Physical Fitness	$29.95
• Number Magic	$19.95
• Beginning Grammar	$29.95

A Calculator, A system, A Whole New Standard.

The finest calculators available for Science, Engineering, & Business.

HEWLETT-PACKARD'S HP-41C



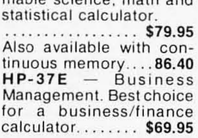
The Calculator.

Features over 130 functions and offers up to 400 lines of program memory or 63 data storage registers — expandable to 319 registers or up to 2,000 lines. RPN Logic. Alpha-numeric capabilities let you communicate with the calculator in English. Customization features allow you to totally reassign the keyboard functions. Continuous memory....... **HP-41C Calculator $288.00**

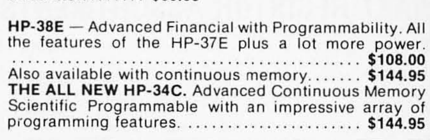
The System.

Memory Modules. For storing programs or up to 2,000 lines of program memory. **$45.00**
"Extra Smart" Card Reader. Records programs and data back onto blank mag-cards. **$179.00**
The Printer. Upper and Lower case. High resolution plotting. Portable. Thermal operation. **$320.00**
Application Modules.................. **$45.00 EACH.**
Standard pac, Statistics, Math, Financial, & Surveying.

HP SERIES E CALCULATORS



HP-31E — Scientific. Trigonometric, exponential & math functions. **$49.95**
HP-32E — Advanced Scientific with Statistics. All HP-31E functions plus hyperbolies and comprehensive statistics. **$66.95**
HP-33E — Programmable Scientific. A programmable science, math and statistical calculator. **$79.95**
Also available with continuous memory.... **86.40**
HP-37E — Business Management. Best choice for a business/finance calculator........ **$69.95**



HP-38E — Advanced Financial with Programmability. All the features of the HP-37E plus a lot more power. **$108.00**
Also available with continuous memory....... **$144.95**
THE ALL NEW HP-34C. Advanced Continuous Memory Scientific Programmable with an impressive array of programming features. **$144.95**

CompuMart STOCKS THE COMPLETE LINE OF MATROX PRODUCTS. CALL FOR SPECS.

Based on our policy of offering our customers only the finest in microcomputers, CompuMart is pleased to announce that we now carry the new generation of Personal Computers by Atari.™



INTRODUCTORY SPECIALS

To celebrate our commitment to Atari, we are offering the following Atari Specials:
(1) **Buy additional memory for your computer, 8K or 16K, and we will double the amount of memory FREE!**
(A potential savings of $200.)
(2) **Buy the Atari 800 Computer and take $100 off the purchase price of the Atari 810 Disk Drive or the Atari 820 printer.**

ATARI® 800™

PERSONAL COMPUTER SYSTEM

Comes with:

- Computer Console
- BASIC Language Cartridge
- Education System Master Cartridge
- BASIC Language Programming Manual
- 800 Operator's Manual
- ATARI 410 Program Recorder
- Invitation to Programming™ Cassette
- 8K RAM Memory Module™
- 10K ROM Operating System
- Power Supply
- TV Switch Box

SPECIFICATIONS:

High resolution color graphics
57 key full stroke keyboard
Built-in RF modulator for channel 2/3 operation with standard TV set
Composite video output for use with monitor
Internal Speaker
Two cartridge slots for rapid program insertion
Four internal slots for expansion up to 48K RAM
6502B Microprocessor
High speed serial 1/0 port

Atari 800 Computer System $995.95

ATARI® 820™ PRINTER

High resolution dot matrix impact printer
Uses standard 3/8 inch roll paper and ribbon
40 characters per line
Speed: 40 characters per second
UL approved

Atari 820 Printer $599.95

ATARI® 810™ PRINTER

Uses standard 5¼ inch diskettes
88K bytes storage per diskette
Up to four disk drive units can operate with the system
Average data access time: 236 milliseconds
Power: AC adapter; UL approved

Atari 810 Disk Drive $699.95

Upgrade your computer with additional memory. (Note that the Atari 800 Computer comes with 8K of RAM memory and will accept up to 48K.)

Atari 8K RAM Memory Module $124.95
Atari 16K RAM Memory Module $199.95

CompuMart
Dept. BY50 ,
270 Third St.,
Cambridge, Mass.
02142

TO ORDER CALL:
1-800-343-5504
IN MASS. CALL: (617) 491-2700

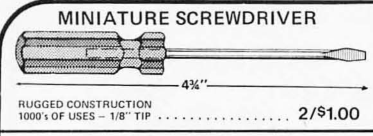
IMPORTANT ORDERING INFORMATION

All orders must include 4% shipping and handling. Mass. residents add 5% sales tax. Mich. residents 4% for sales tax.

Phones open from 8:30 a.m. to 5:30 p.m. EST. Mon.-Fri. • P.O.s accepted from D&B rated companies – shipment contingent upon receipt of signed purchase order • All prices are subject to change without notice • Most items in stock for immediate shipment – call for delivery quotation • In the Ann Arbor area? Our retail store is open 11:00 a.m. to 7:00 p.m. Tues.-Fri. 10:00 a.m. to 5:00 p.m. Saturdays (closed Sun. and Mon.)

***IF NOT SATISFIED RETURN PURCHASE WITHIN 10 DAYS FOR A FULL REFUND.**

Circle 273 on inquiry card.

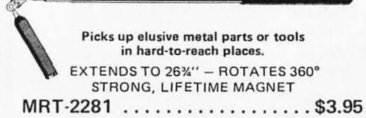


MINIATURE SCREWDRIVER

4¾"

RUGGED CONSTRUCTION
1000's OF USES – 1/8" TIP .... 2/$1.00

MAGNETIC RETRIEVER TOOL



Picks up elusive metal parts or tools in hard-to-reach places.

EXTENDS TO 26¾" – ROTATES 360°
STRONG, LIFETIME MAGNET

MRT-2281 .... $3.95



CONTINENTAL SPECIALTIES

LOGIC PROBE KIT



SPECIFICATIONS

Input Impedance: 300,000 Ohms.
Thresholds: "Lo" 30%Vcc – "Hi" 70%Vcc
Maximum Speed: 300 nsec., 1.5MHz
Input Protection: ±50VDC continuous 117VAC for 15 sec.
Power: 30mA @5V – 40mA @ 15V – 25V max. reverse voltage protected; 36" cable with color coded clips included.
Operating Temp.: 0-50°C.
Dimensions: 5.8L x 1.0W x 0.7D in. (147 x 25 x 18mm)
Weight: 30 oz. (85 gm)

LPK-1 .... $21.95/Kit

Proto Clips



14-PIN CLIP	PC-14	$ 4.50
16-PIN CLIP	PC-16	$ 4.75
24-PIN CLIP	PC-24	$10.00
40-PIN CLIP	PC-40	$16.00

Proto Boards

PB-6	$17.95
PB-100	19.95
PB-101	22.95
PB-102	26.95
PB-103	44.95
PB-104	55.95
PB-203	99.95
PB-203A	155.00
PB-203A-Kit	131.00

Jumbo 6-Digit Clock Kit

* Four .630"ht. and two .300"ht. common anode displays
* Uses MM5314 clock chip
* Switches for hours, minutes and hold functions
* Hours easily viewable to 30 feet
* Simulated walnut case
* 115VAC operation
* 12 or 24 hour operation
* Includes all components, case and wall transformer
* Size: 6¾ x 3⅛ x 1¾

JE747 .... $29.95



* Bright .300 ht. comm. cathode display
* Uses MM5314 clock chip
* Switches for hours, minutes and hold modes
* Hrs. easily viewable to 20 ft.
* Simulated walnut case
* 115 VAC operation
* 12 or 24 hr. operation
* Incl. all components, case & wall transformer
* Size: 6¾" x 3-1/8" x 1¾"

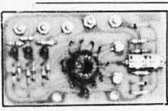
JE701

6-Digit Clock Kit $19.95

Regulated Power Supply

Uses LM309K. Heat sink provided. PC board construction. Provides a solid 1 amp @ 5 volts. Can supply up to ±5V, ±9V and ±12V with JE205 Adapter. Includes components, hardware and instructions. Size: 3½" x 5" x 2"H

JE200....... $14.95



ADAPTER BOARD
– Adapts to JE200 – ±5V, ±9V and ±12V

DC/DC converter with +5V input. Toriodal hi-speed switching XMFR. Short circuit protection. PC board construction. Piggy-back to JE 200 board. Size: 3½" x 2" x 9/16"H

JE205 .... $12.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES		
8080A	CPU	$ 7.95
8212	8-Bit Input/Output	3.25
8214	Priority Interrupt Control	5.95
8216	Bi-Directional Bus Driver	3.49
8224	Clock Generator/Driver	3.95
8226	Bus Driver	3.49
8228	System Controller/Bus Driver	4.95
8238	System Controller	5.95
8251	Prog. Comm. 1/0 (USART)	7.95
8253	Prog. Interval Timer	14.95
8255	Prog. Periph. 1/0 (PPI)	9.95
8257	Prog. DMA Control	19.95
8259	Prog. Interrupt Control	19.95
6800/6800 SUPPORT DEVICES		
MC6800	MPU	$14.95
MC6802CP	MPU with Clock and Ram	24.95
MC6810API	128X8 Static Ram	5.95
MC6821	Periph. Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	12.95
MC6830L8	1024X8 Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	7.95
MC6852	Synchronous Serial Data Adapt.	9.95
MC6860	0-600 bps Digital MODEM	12.95
MC6862	2400 bps Modulator	14.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25
MICROPROCESSOR CHIPS—MISCELLANEOUS		
Z80(780C)	CPU	$13.95
Z80A(780-1)	CPU	15.95
CDP1802	CPU	19.95
2650	MPU	19.95
6502	CPU	11.95
8035	8-Bit MPU w/clock, RAM, 1/0 lines	19.95
P8085	CPU	19.95
TMS9900JL	16-Bit MPU w/hardware, multiply & divide	49.95
SHIFT REGISTERS		
MM500H	Dual 25 Bit Dynamic	$.50
MM503H	Dual 50 Bit Dynamic	.50
MM504H	Dual 16 Bit Static	.50
MM506H	Dual 100 Bit Static	.50
MM510H	Dual 64 Bit Accumulator	.50
MM5016H	500/512 Bit Dynamic	.89
2504T	1024 Dynamic	3.95
2518	Hex 32 Bit Static	4.95
2522	Dual 132 Bit Static	2.95
2524	512 Static	.99
2525	1024 Dynamic	2.95
2527	Dual 256 Bit Static	2.95
2528	Dual 250 Static	4.00
2529	Dual 240 Bit Static	4.00
2532	Quad 80 Bit Static	2.95
3341	Fifo	6.95
74LS670	4X4 Register File (TriState)	2.49
UART'S		
A-Y-5-1013	30K BAUD	5.95

MICROPROCESSOR MANUALS			
M-Z80	User Manual		$7.50
M-CDP1802	User Manual		7.50
M-2650	User Manual		5.00
ROM'S			
2513(2140)	Character Generator(upper case)		$9.95
2513(3021)	Character Generator(lower case)		9.95
2516	Character Generator		10.95
MM5230N	2048-Bit Read Only Memory		1.95
RAM'S			
1101	256X1	Static	$1.49
1103	1024X1	Dynamic	.99
2101(8101)	256X4	Static	3.95
2102	1024X1	Static	1.75
21L02	1024X1	Static	1.95
2111(8111)	256X4	Static	3.95
2112	256X4	Static MOS	4.95
2114	1024X4	Static 450ns	7.95
2114L	1024X4	Static 450ns low power	10.95
2114-3	1024X4	Static 300ns	10.95
2114L-3	1024X4	Static 300ns low power	11.95
5101	256X4	Static	7.95
5280/2107	4096X1	Dynamic	4.95
7489	16X4	Static	1.75
74S200	256X1	Static Tristate	4.95
93421	256X1	Static	2.95
UPD414 (MK4027)	4K	Dynamic 16 pin	4.95
UPD416 (MK4116)	16K	Dynamic 16 pin 250ns	9.95
TMS4044-45NL	4K	Static	14.95
TMS4045	1024X4	Static	14.95
2117	16,384X1	Dynamic 350ns (house marked)	9.95
MM5262	2KX1	Dynamic	4/1.00
PROM'S			
1702A	2048	FAMOS	$5.95
2716INTEL	16K*	EPROM	59.95
TMS2516	16K*	EPROM	39.95
(2716)	*Requires single +5V power supply		
TMS2532	4KX8	EPROM	89.95
2708	8K	EPROM	10.95
2716 T.I	16K**	EPROM	29.95
	**Requires 3 voltages, —5V, +5V, +12V		
5203	2048	FAMOS	14.95
6301-1(7611)	1024	Tristate Bipolar	3.49
6330-1(7602)	256	Open C Bipolar	2.95
82S23	32X8	Open Collector	3.95
82S115	4096	Bipolar	19.95
82S123	32X8	Tristate	3.95
74186	512	TTL Open Collector	9.95
74188	256	TTL Open Collector	3.95
74S287	1024	Static	2.95

JE600 HEXADECIMAL ENCODER KIT

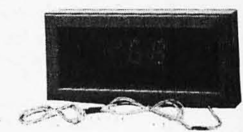
FEATURES:
* Full 8 bit latched output for microprocessor use
* 3 User Define keys with one being bistable operation
* Debounce circuit provided for all 19 keys
* LED readout to verify entries
* Easy interfacing with standard 16 pin 1C connector
* Only +5VDC required for operations

FULL 8 BIT LATCHED OUTPUT—19 KEYBOARD

The JE600 Encoder Keyboard provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8 bit microprocessor or 8 bit memory circuits. Three (3) additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with LED readouts. Also included is a key entry strobe.

JE600 .... $59.95
Hexadecimal Keypad only $14.95

DIGITAL THERMOMETER KIT



* Dual sensors—switching control for in-door/outdoor or dual monitoring
* Continuous LED .8" ht. display
* Range: -40°F to 199°F / -40°C to 100°C
* Accuracy: ±1° nominal
* Set for Fahrenheit or Celsius reading
* Sim. walnut case - AC wall adapter incl.
* Size: 3-1/4"H x 6-5/8"W x 1-3/8"D

JE300 .... $39.95

62-Key ASCII Encoded Keyboard Kit

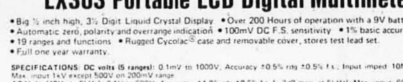


The JE610 62-Key ASCII Encoded Keyboard Kit can be interfaced into most any computer system. The JE610 Kit comes complete with an industrial grade keyboard switch assembly (62 keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and –12V @ 10mA for operation.

FEATURES:
* 60 Keys generate the full 128 characters, upper and lower case ASCII set
* Fully buffered
* 2 user-define keys provided for custom applications
* Caps lock for upper case only alpha characters
* Utilizes a 2376 (40 pin) encoder read only memory chip
* Outputs directly compatible with TTL/DTL or MOS logic arrays
* Easy interfacing with a 16-pin dip or 18-pin edge connector

JE610 ..... $79.95
62-Key Keyboard only . . $34.95

HICKOK LX303 Portable LCD Digital Multimeter



* Big ½ inch high, 3½ Digit Liquid Crystal Display
* Over 200 Hours of operation with a 9V battery
* Automatic zero, polarity and overrange indication
* 100mV DC F.S. sensitivity
* 1% basic accuracy
* 19 ranges and functions
* Rugged Cycolac® case and removable cover, stores test lead set.
* Full one year warranty.

SPECIFICATIONS: DC volts (5 ranges): 0.1mV to 1000V, Accuracy ±0.5% rdg ±0.5% f.s., Input imped. 10MΩ, Max. input 1kV except 500V on 200mV range.
AC Volts (40Hz to 5kHz): 0.1V to 600V, Accuracy ±1.0% rdg ±0.5% f.s. (–2dB max. at 5kHz); Max. input 600V.
Resistance (6 Low Power Ranges): 0.1 to 20MΩ; Accuracy ±0.5% rdg ±0.5% f.s. (±1.5% rdg on 20MΩ range), input protected to 120VAC all ranges.
DC Current (6 ranges): 01nA to 100mA; Accuracy ±1.0% rdg ±0.5% f.s.
Dimensions and Weight: 5-7/8" x 3-3/8" x 1-3/4", 8 oz., POWER: 9V battery (not included) or Hickok AC adapter. READ RATE: 3/sec

LX303 Digital Multimeter $74.95

PART NO.	DESCRIPTION	PRICE
RC-3	115V AC ADAPTER	7.50
CC-3	PADDED CARRYING CASE	7.50
VP-10	X10 DC PROBE ADAPTER (Up to 10K)	14.95
VP-40	40kV DC PROBE	35.00
CS-1	10 Amp DC Current Shunt	14.95

$10.00 Min. Order – U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage – Add 5% plus $1 Insurance (if desired)

Spec Sheets – 25¢
1980 Catalog Available – Send 41¢ stamp



PHONE ORDERS WELCOME (415) 592-8097

MAIL ORDER ELECTRONICS – WORLDWIDE
1355 SHOREWAY ROAD, BELMONT, CA 94002
PRICES SUBJECT TO CHANGE

5-80

The Incredible "Pennywhistle 103"



$139.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modem and terminal for telephone "hamming" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

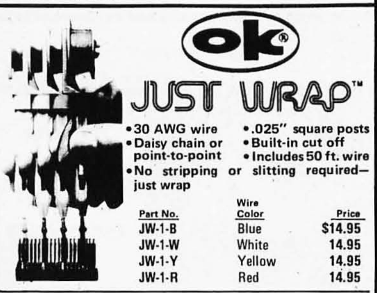
Data Transmission Method .... Frequency-Shift Keying, full-duplex (half-duplex selectable).
Maximum Data Rate .... 300 Baud.
Data Format .... Asynchronous Serial (return to mark level required between each character).
Receive Channel Frequencies ... 2025 Hz for space; 2225 Hz for mark.
Transmit Channel Frequencies .. Switch selectable: Low (normal) = 1070 space, 1270 mark; High = 025 space, 2225 mark.
Receive Sensitivity .... –46 dbm accoustically coupled.
Transmit Level .... –15 dbm nominal. Adjustable from –6 dbm to –20 dbm.
Receive Frequency Tolerance ... Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz.
Digital Data Interface .... EIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar).
Power Requirements .... 120 VAC, single phase, 10 Watts.
Physical .... All components mount on a single 5" by 9" printed circuit board. All components included.

Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
* 8 each UPD416-1 (16K Dynamic Rams) 250NS
* Documentation for conversion

TRS-16K $75.00



* 30 AWG wire
* Daisy chain or point-to-point
* No stripping or slitting required—just wrap
* .025" square posts
* Built-in cut off
* Includes 50 ft. wire

Part No.	Wire Color	Price
JW-1-B	Blue	$14.95
JW-1-W	White	14.95
JW-1-Y	Yellow	14.95
JW-1-R	Red	14.95

JUST WRAP™ Replacement Wire

Part No.	Color		Price
R-JW-B	Blue	50 ft. roll	$2.98
R-JW-W	White	50 ft. roll	2.98
R-JW-Y	Yellow	50 ft. roll	2.98
R-JW-R	Red	50 ft. roll	2.98

JUST WRAP™ Unwrap Tool $3.49

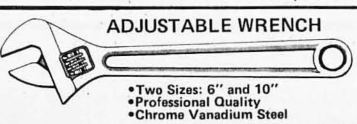


Vacuum Vise

Vacuum-based light-duty vise for small components and assemblies. ABS construction. 1½" jaws, 1¼" travel. Can be permanently installed.

VV-1 .... $3.49

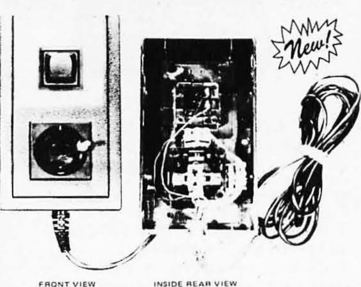
ADJUSTABLE WRENCH



* Two Sizes: 6" and 10"
* Professional Quality
* Chrome Vanadium Steel

6" – AW-6 . . $4.95   10" – AW-10 . . $6.95

JOYSTICK VIDEO CONTROLLER



* IDEAL FOR ALL VIDEO GAMES OR REMOTE CONTROL PROJECTS
* SMALL CASE SIZE: 1-1/2"H x 2-3/8"W x 4-5/16"L
* 2 MINIATURE POTENTIOMETERS – 40K OHM EACH
* SPST PUSH BUTTON CONTROL
* 5-WIRE CONNECTION CABLE – 5 FEET LONG
* RUGGED PLASTIC CASE

JVC-40 ...... $4.95 each

Circle 274 on inquiry card.

Word Processing for UCSD Pascal

PROFF formats and prints out text files. FORML interacts with PROFF to produce multiple copies of a form letter, each with a different addressee. Features include:

- —multi file input
- —interactive debug
- —adjustable margins
- —filling, centering
- —underscoring

Each program is written in UCSD Pascal and is distributed on floppy disk. User manuals are included or can be purchased separately. Volume discounts are available.

(714) 452-0681
Renaissance Systems Inc.
11760 Sorrento Valley Rd.
San Diego, Ca. 92121

Circle 275 on inquiry card.

16 K RAMS & RAM CONTROLLERS

16 K X 1 DYNAMIC RAMS MK4116P3
- 200 NSEC ACCESS/375 NSEC CYCLE TIMES
- 16 PIN/TTL COMPATIBLE
- ALL CHIPS BURNED IN AND FULLY TESTED
- PRICE WITH DATA SHEET

$68.00 IN QTY OF 8/THAT'S $8.50 EACH

6800/6502 64K BYTE RAM & CONTROLLER SET
MAKE 64K BYTE MEMORY FOR YOUR 6800 OR 6502
THIS SET INCLUDES:
- 32 M5K 4116-3, 16K X 1, 200 NSEC RAMS
- 1 MC3480 MEMORY CONTROLLER
- 1 MC3242A MEMORY ADDRESS MULTIPLEXER AND COUNTER
- DATA & APPLICATION SHEETS. PARTS TESTED AND GUARANTEED.

$295.00 PER SET

DYNAMIC MEMORY CONTROLLER MC3480L
- GENERATES RAS/CAS & REFRESH TIMING FOR 16K TO 64K BYTE MEMORIES
- PRICE WITH DATE SHEET: $13.95 EACH

MEMORY ADDRESS MUX/COUNTER MC3242AP
- MUX ADDRESS & REFRESH COUNTER FOR 16K TO 64K BYTE MEMORIES
- PRICE WITH DATA SHEET: $12.50 EACH

QUANTITY DISCOUNTS AVAILABLE

ALL ORDERS POSTPAID. U.S. FUNDS ON INTERNATIONAL ORDERS. CHECK OR MONEY ORDER, VISA/BA/MC ALSO ACCEPTED. SEND ACCT. NO., EXPIRATION DATE, & INTERBANK NO. WITH SIGNED ORDER. CALIF. RESIDENTS PLEASE ADD 6% SALES TAX. PHONE ORDERS: (714) 633-4460

MEASUREMENT SYSTEMS & CONTROLS, INC.
MEMORY DEVICES DIVISION
867 NORTH MAIN ST., ORANGE, CA 92668

DISK DRIVE/CRT ★SALE★

Shugart SA801R for RS MOD. II ONLY

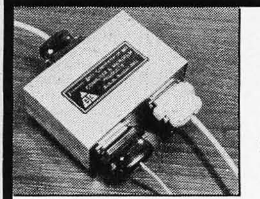
$489

Hazeltine 1000 (unused)	$ 599
Shugart SA400	282
Pertec FD200..... $282 — FD250	399
MPI B51 .... $279 — B52	399
SA801R w/PS/Cab	799
Dual Drives w/PS/Cab	1645

LIMITED QUANITITES

MTI 3304 W. MacArthur Blvd. Santa Ana, CA 92704
(714) 979-9923

Circle 277 on inquiry card.



TERMINAL DATA CORPORATION

MODEL 1200 RS-232 DATA SPLITTER
available in kit form

Model 1200K gives the terminal or microprocessor user a second interface for a printer, plotter, cassette or tape drive. It operates at any speed & isolates the two output devices from each other, while providing 2 RS-232 interfaces from the terminal or microprocessor.

The kit consists of 3 RS-232 connectors, printed circuit board, all necessary components, enclosure, mounting hardware & assembly instructions $64.00

write or call

TERMINAL DATA CORP.
11878 Coakley Cir.
Rockville, MD 20852
(301) 881-7655

Circle 278 on inquiry card.

MYCHESS

- Highest scoring microcomputer chess program at the 1979 ACM North America Computer Chess Championship.
- Available for CP/M, CDOS, IMDOS, TRS-80, hard-sectored North Star with CP/M
- Program allows 9 levels of play
- Searches on the opponent's time
- Program enables you to save game for later play
- Optional formated hard copy of game
- Allows computer to play itself

$50.00

Contact:

COMPUTER SERVICES
2431 Lyvona Lane
Anchorage, AK 99502
(907) 243-8730

Circle 279 on inquiry card.

Floppys & Systems Repair

DRIVES

- *Per Sci - Shugart*
- *Pertec - Micropolis*

COMPUTERS

- *Apple - TRS-80*

Computer Service Center
1023 N. La Brea
Hollywood, CA 90038
(213) 851-2226

Circle 280 on inquiry card.

SURPLUS ELECTRONICS

ASCII ASCII ®

IBM SELECTRIC BASED I/O TERMINAL WITH ASCII CONVERSION INSTALLED $645.00

- Tape Drives • Cable
- Cassette Drives • Wire
- Power Supplies 12V15A, 12V25A, 5V35A Others, • Displays
- Cabinets • XFMRS • Heat Sinks • Printers • Components

Many other items, SEND $1.00 FOR CATALOG REFUNDABLE FIRST ORDER
WORLDWIDE ELECT, INC.
130 Northeastern Blvd.
Nashua, NH 03060
Phone orders accepted using VISA or MC
Call 603-889-7661

Circle 281 on inquiry card.

MAGIC WAND™
Word Processing System

$400

Starburst Computer Group, Inc.
Route 2 Box 183
Afton Virginia 22920
(Authorized Dealer)

Magic Wand works on any CP/M® system with all major CRT's. Ask for our free point-by-point comparison of Magic Wand and two popular word processing systems.

Magic Wand is a Trademark of Small Business Applications Inc.
"CP/M is a registered Trademark of Digital Research"

(804) 361-1180

Circle 282 on inquiry card.

H9 OWNERS!

Upgrade your video terminal with one of these long overdue kits:

GRAFIX —Graphical display capabilities assembled and tested $69.95. Kit $59.95.

CURSOR CONTROL — A total of 8 functions assembled and tested $34.95. Kit $29.95.

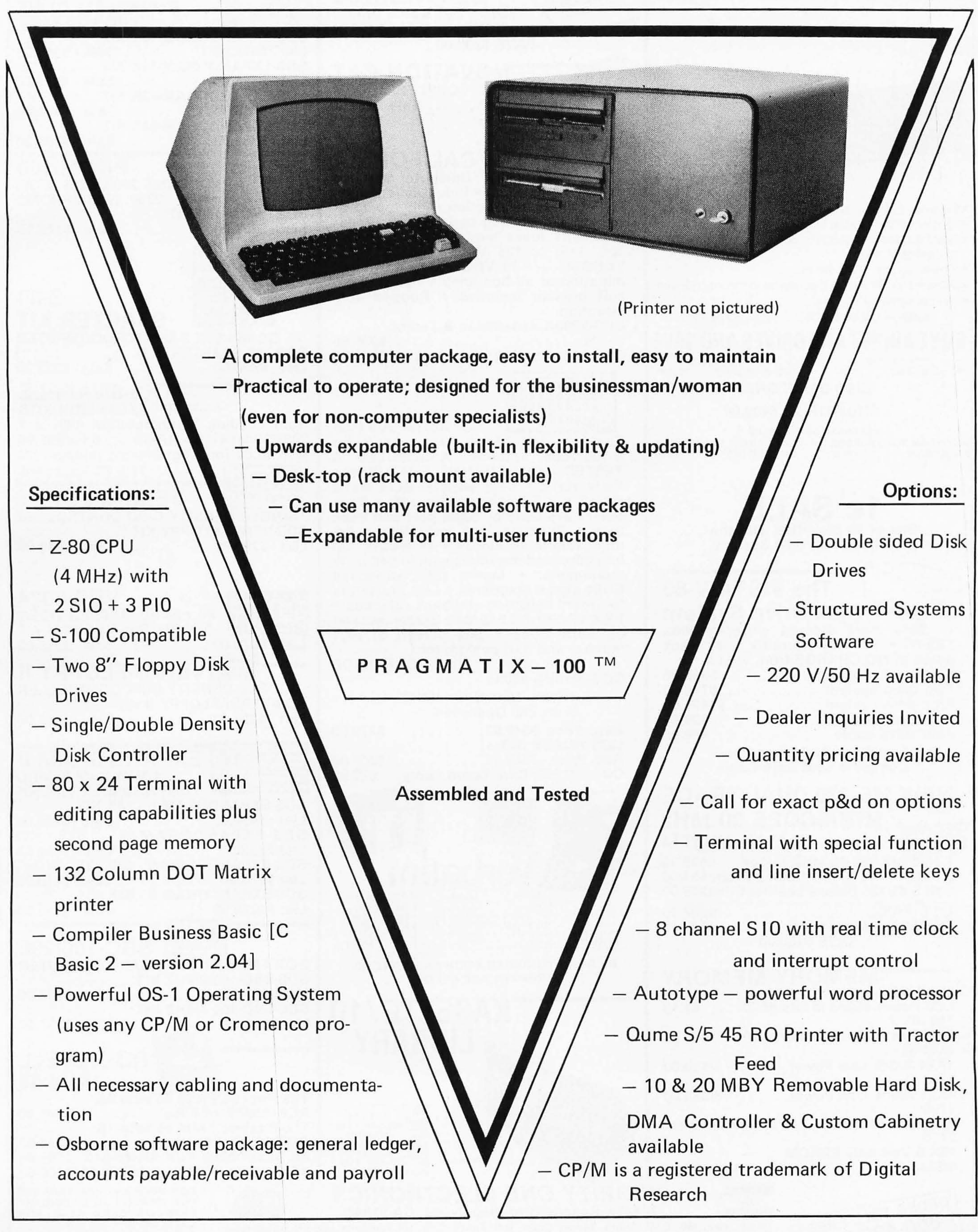
FLICKER FREE — 4800 baud operation assembled and tested $79.95. Kit $69.95.

All have a full 6 month warranty.

NORTHWEST COMPUTER SERVICES, INC.
8503 N.E. 30th Avenue
Vancouver, WA 98665

Circle 283 on inquiry card.

PRAGMATIX-100



In California: 415-321-5601
Outside Ca.: 800-227-8266

Electrolabs

POB 6721, Stanford, Ca. 94305

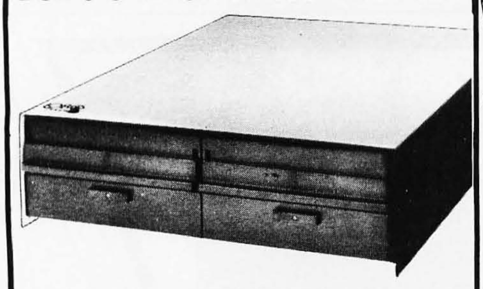
Worldwide:
TLX: 345567 Electrolabs PLA

Circle 284 on inquiry card.

PRIORITY ONE ELECTRONICS

SEND $1.00 FOR 52 PAGE CATALOG

LOBO 8" DISK DRIVE CABINET



New from Lobo, a dual Cabinet with power supply, and internal data cable hook-up.

- Cabinet accepts 2 801R, 800R, FD120, or FD200 style disk drives.
- Power Supply for 2 drives.
- Assembled, tested and guaranteed by Lobo Drives.
- Shipping Weight 30 lbs.

LBO — DUAL 8 PCS..........$329.00

BUY CABINET AND DRIVES AND $AVE

WITH 1 DRIVE	WITH 2 DRIVES
LBO-801R-1PSC $775.00	LBO-801R-2PSC $1250.00

DISC DRIVE ONLY

SHU-801R.......$499.00

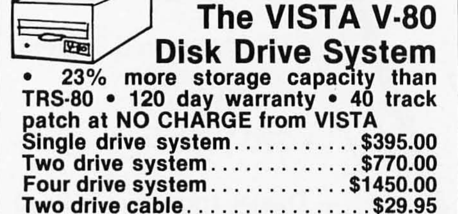
EXTERNAL DATA CABLES

CARDEDGE TO CARDEDGE	CARDEDGE TO SOCKET
PRI-50CE-CE $19.95	PRI-50CE-SKT $19.95

1¢ SALE

Box of 10 Diskettes with the Purchase of a V-80 System

The VISTA V-80 Disk Drive System



- 23% more storage capacity than TRS-80 • 120 day warranty • 40 track patch at NO CHARGE from VISTA

Single drive system...........$395.00
Two drive system.............$770.00
Four drive system............$1450.00
Two drive cable..............$29.95
Four drive cable.............$39.95

Two Drive Systems comes Complete with Data Cable

NEW MS-230 DUAL TRACE MINISCOPE 30 MHz BANDWIDTH

1 NLS MS-230 30 MHZ Scope...$598.15
2 NLS 41-141 10 to 1 Combo Probe$54.00
1 NLS 41-180 Deluxe Leather Case$45.00

LIST PRICE..................$697.15
MS 230 COMBO PRICE........ $547.15
SAVE $150.00

MEMORY MEMORY

2102LIPC
Low Power 450ns in lots of 20.....$1.10
2102AL-2
Low Power 250ns in lots of 20.....$1.25
2114-3L
1Kx4 300ns Low Power........8/$50.00
5257-3L
4Kx1 300ns Low Power........8/$55.00
2708
8K 450ns EPROM ....8/$60.00-$8.50 ea.
2716
16K 5 Volt only EPROM
8/$248.00..................$32.00 ea.

CENTRONICS

730 - 1 Dot Matrix Printer
List - $995.00...Sale - $795.00
SAVE $200.00

NOVATION CAT

ACOUSTIC COUPLER/MODEM
List - $199.00............ Sale $156.00

CALIFORNIA

Computer Systems

• S-100 compatible • Industrial/commercial quality construction • Flip-top cover • Excellent cooling capability • 12 slot capability (uses model 2501A) • Input 105, 115, or 125 VAC • Output + 8 VDC20A, + −16 VDC 4A • Active termination of all bus lines • Fan and circuit breaker included • Rugged construction

CCS-2200A Assembled & Tested
35 lbs........................$399.95
CCS-2200AK Kit 35 lbs.........$349.95



CCS-M-XVI-M

The true 16K Static Ram module for S-100 bus systems. ASSEMBLED & TESTED --100% BURN IN - FEATURES: • Fully static • Uses popular 2114 static RAMS • +5 volt operation only • Bank Select available by bank port and bank byte • Phantom Line capability • Addressable in 4K blocks • 4K blocks can be addressed anywhere with in 64K in 4k increments. • Meets IEEE proposed S-100 signal standards • LED indicators for board selection and bank selection • FR-4 EPOXY PC boards • Solder masked on both sides • Silk screen of part number and part designator.

OUR PRICE

CCS-2016BA 450ns
100% Tested for 4MHZ
Z80 Operation
Reg. Price $349.95............$279.95
CCS-2016BB 300ns
Reg. Price - $389.95............$309.00
CCS-2016BY Bare Board - only...$29.95



Part No.	Sectoring	Application	Pk. of 2	Box of 10
VRB-MD 525-01	Soft Sector	TRS-80 Apple	$ 8.95	$29.95
VRB-MD 525-10	Hard 10 Sector	North Star	$ 8.95	$29.95
VRB-MD 525-16	Hard 16 Sector	Micropolis	$ 8.95	$29.95
VRB-FD32-1000	Hard Sector	Shugart 801R	$11.95	$37.00
VRB-FD34-1000	Soft Sector	IBM 3740	$11.95	$37.00

SHIPPING WEIGHT 1 LB.

BE SURE TO ORDER YOUR KASSETTE/10 LIBRARY CASE BELOW

KASETTE/10 LIBRARY



Part No.		
MMM-KS-10-	GREY BLACK BLUE BIEGE	8" DISKETTE HOLDER $4.50 or 3/$10.00
MMM-KM-10-	GREY BLACK BLUE BEIGE	5¼" DISKETTE HOLDER $4.25 or 3/$10.00

SD EXPANDORAM

EXPANDABLE TO 64K
USING 4116 RAMS

SDS-EXPANDORAM-16K KIT
List - $385.00............Sale - $205.00
SDS-EXPANDORAM-32K KIT
List - $550.00............Sale - $269.00
SDS-EXPANDORAM-48K KIT
List - $715.00............Sale - $330.00
SDS-EXPANDORAM-64K KIT
List - $880.00............Sale - $390.00

PROM-100

PROGRAMS 2708, 2716, 2732, 2758, 2516 EPROMS
SDS-PROM-100 KIT
List - $200.00............Sale - $175.95



Z-80 STARTER KIT

COMPLETE Z-80 MICROCOMPUTER
SDS-Z80 STARTER KIT
List - $340.00............Sale - $239.00

TRS-80/APPLE

MEMORY EXPANSION KITS
from Leading Manufacturers (16K x 1 200/250ns) 4116's RAMS....8 for $55.00
Add $3.00 for programming jumpers for TRS 80 Keyboard.

VERSAFLOPPY

SINGLE DENSITY DISC CONTROLLER
SDS-VERSAFLOPPY KIT
List - $250.00.............Sale $235.00

VDB-8024

80 x 24 I/O MAPPED VIDEO BOARD SDS-VDB-8024 KIT
List - $375.00............Sale - $315.00

VERSAFLOPPY II

DOUBLE DENSITY DISK CONTROLLER
SDS-VERSAFLOPPY II KIT
List - $350.00............Sale - $299.00



EXPANDORAM II

4 MHz RAM BOARD
EXPANDABLE TO 256K
SDS-EXPANDORAM-II - 16K KIT
List - $470.00............Sale - $280.00
SDS-EXPANDORAM-II - 32K Kit
List 720.00.............Sale - $360.00
SDS-EXPANDORAM-II - 48K KIT
List $970.00............Sale - $440.00
SDS-EXPANDORAM-II - 64K KIT
List $1220.00............Sale - $510.00

SBC-100/200

2 OR 4 MHz SINGLE BOARD COMPUTER
SDS-SBC-100 2MHZ KIT
List-$295.00 .... Sale-$235.00
SDS-SBC-200 4MHZ KIT
List-$320.00 .... Sale-$255.00



ROCKWELL AIM-65

The Rockwell AIM 65 with 4K
RCK-AIM65 4K 8 lbs...............$445.00
The Rockwell AIM 65 with 1K
RCK-AIM65 1K 8lbs...........$375.00
4K Assembled--RCK-AIM65-010 ..$85.00
8K Basic in ROM RCK-AIM65-020$100.00

SEND $1.00 FOR 52 PAGE CATALOG

ORDER TOLL FREE
1-800-423-5633
except CA., AK., Hi., CALL
(213) 894-8171



PRIORITY ONE ELECTRONICS
16723K Roscoe Blvd. Sepulveda, CA 91343



Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax, Minimum order $10.00 Prepaid U.S. orders less than $75.00 include 5% shipping and handling. MINIMUM $2.50. Excess refunded. Just in case ... please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru MAY 1980.
*SOCKET and CONNECTOR prices based on GOLD, not exceeding $500 per oz.

*Sale Prices are for prepaid orders only credit card orders will be charged appropriate freight

FOR MORE INFORMATION SEE OUR 52 PAGE AD in JANUARY BYTE OR SEND $1.00 FOR CATALOG
• Sale Prices are for prepaid orders only • Quantities are limited, subject to prior sale • CREDIT CARD ORDERS WILL BE CHARGED APPROPRIATE FREIGHT

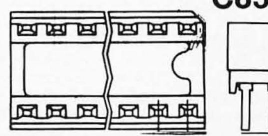


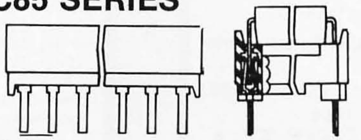
PRIORITY ONE ELECTRONICS



Texas Instruments

FACE GRIP LOW PROFILE SOLDER TAIL DIP SOCKETS C85 SERIES





- Face grip design provides maximum retention force
- Anti-wicking feature
- Redundant contact points

PART NO.	PINS	PRICE 1-9	10-49	50-99	100-499	500-999	1,000 +
TIS-08LP	08	N/A	.15	.10	.08	.07	.06
TIS-14LP	14	N/A	.18	.15	.14	.12	.11
TIS-16LP	16	N/A	.20	.18	.16	.13	.12
TIS-18LP	18	.30	.25	.22	.18	.15	.13
TIS-20LP	20	.30	.25	.23	.20	.17	.145
TIS-22LP	22	.35	.30	.25	.22	.19	.17
TIS-24LP	24	.40	.35	.30	.24	.20	.18
TIS-28LP	28	.45	.40	.35	.28	.24	.21
TIS-40LP	40	.50	.45	.42	.40	.35	.31

*MINIMUM ORDER $1.00 Per Line item
Sockets purchased in multiples of 100 per type may be combined for best price

DIP PLUGS

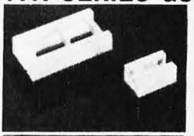
PART NO.	PINS	PRICE 1-9	10-24	25-99	100-249
KNX-08DP	8	.50	.45	.43	.40
KNX-14DP	14	.65	.60	.58	.55
KNX-16DP	16	.70	.65	.62	.58
KNX-24DP	24	1.15	1.05	.90	.95
KNX-40DP	40	1.90	1.70	1.60	1.50

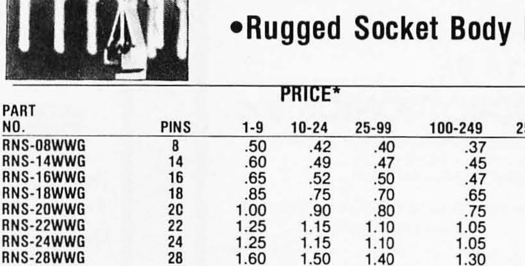


GOLD 3 LEVEL WIRE WRAP SOCKETS

AND OTHER LEADING MANUFACTURES

IYN SERIES GOLD 3 LEVEL WIRE WRAP SOCKETS



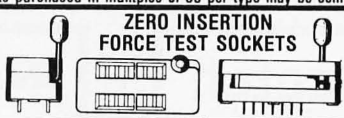


- Deep Chamfered Closed Entry Contacts
- RN Side Wipe Contact Design
- Terminal Barbs Allow Self-lock into PC Board
- Rugged Socket Body Design

PART NO.	PINS	PRICE* 1-9	10-24	25-99	100-249	250-999
RNS-08WWG	8	.50	.42	.40	.37	.33
RNS-14WWG	14	.60	.49	.47	.45	.42
RNS-16WWG	16	.65	.52	.50	.47	.44
RNS-18WWG	18	.85	.75	.70	.65	.60
RNS-20WWG	20	1.00	.90	.80	.75	.70
RNS-22WWG	22	1.25	1.15	1.10	1.05	1.00
RNS-24WWG	24	1.25	1.15	1.10	1.05	1.00
RNS-28WWG	28	1.60	1.50	1.40	1.30	1.20
RNS-40WWG	40	1.85	1.65	1.55	1.45	1.35

*Price based on gold not exceeding $500 per oz.
Sockets purchased in mulitples of 50 per type may be combined for best price.

ZERO INSERTION FORCE TEST SOCKETS



ZIP-16DIP $5.50
ZIP-24DIP $7.50
ZIP-40DIP $10.25

SEND $1.00 FOR 52 PAGE CATALOG



Texas Instruments

Gold Plated Edgeboard Connectors

Standard But Not Ordinary

The H4 Series standard edgeboard connectors offer the best value in the edgeboard market today.

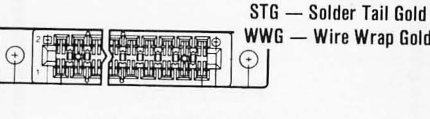
To assure reliable electrical connections, our cantilever contacts are pre-loaded for optimum normal force and bifurcated for redundancy; each contact point features from 50 (Wire Wrap*) to 75 (solder tail) microinches (minimum) of wrought gold inlay over a nickel diffusion barrier. The inlay is metallurgically bonded to a copper-nickel-tin alloy (CA 725) that is suited to both soldered and wire wrapped terminations. The dielectric contact-housing is made of glass-filled thermoplastic polyester, meeting U.L. Flammability Classification 94V-0.

FEATURES

RELIABLE, COST-EFFICIENT CONTACT DESIGN
- 50 (Wire Wrap) to 75 (solder tail) microinches gold inlay over a nickel diffusion barrier (minimum thickness).
- Copper-nickel-tin CA 725 Alloy.
- Bifurcated contact points.
- Preloaded, cantilever spring design.
- Contacts are user removable.

RUGGED BODY
- Glass-filled thermoplastic polyester — Meets U.L. Flammability Classification 94V-0. — Resists common cleaning solvents.
- Solder standoff — Facilitates cleaning — Reduces solder wicking
- Between contact polarization key (snaplock for .100" & .125" centers).
- Generous chamfered card slot.
- Molded contact identification — Alphanumeric (.156" centers) — Numeric (.100" & .125" centers).
- Location ridges (bottom) and raised dots (top) mark every fifth contact position.
- Entire connector design is U.L. Approved.

ABBREVIATIONS:
STG — Solder Tail Gold
WWG — Wire Wrap Gold



TI EDGE CONNECTORS

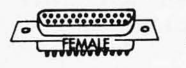
.1" Contact Centers: STG - Soldertail GOLD; WWG - Wire Wrap GOLD

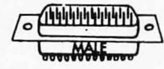
PART NO.	PRICE 1-9	10-24	25-99	100-249
TIC-1530-1 STG	1.60	1.45	1.30	1.10
TIC-1530-1 WWG	1.70	1.55	1.35	1.15
TIC-1836-1 STG	2.00	1.80	1.60	1.40
TIC-1836-1 WWG	2.10	1.90	1.65	1.45
TIC-2244-1 STG	2.25	2.00	1.75	1.50
TIC-2244-1 WWG	2.40	2.15	1.90	1.60
TIC-2550-1 STG	2.50	2.25	2.00	1.65
TIC-2550-1 WWG	2.70	2.45	2.15	1.80
TIC-3060-1 STG	2.95	2.60	2.30	1.90
TIC-3060-1 WWG	3.20	2.85	2.55	2.20
TIC-3672-1 STG	3.30	2.95	2.60	2.30
TIC-3672-1 WWG	3.90	3.50	3.10	2.60
TIC-4080-1 STG	3.60	3.25	2.85	2.40
TIC-4080-1 WWG	4.40	4.00	3.60	3.00
TIC-4386-1 STG	3.90	3.50	3.10	2.60
TIC-4386-1 WWG	4.65	4.15	3.70	3.10
TIC-50100-1 STG	4.50	4.05	3.60	3.00
TIC-50100-1 WWG	5.40	4.90	4.30	3.60

.125" Contact Centers: STG - Soldertail GOLD; WWG - Wire Wrap GOLD

PART NO.	PRICE 1-9	10-24	25-99	100-249
TIC-2244-2 STG	2.30	2.10	1.85	1.50
TIC-2244-2 WWG	2.60	2.35	2.10	1.75
TIC-2856-2 STG	2.80	2.55	2.25	1.85
TIC-2856-2 WWG	3.20	2.90	2.55	2.15
TIC-3060-2 STG	2.90	2.60	2.30	1.95
TIC-3060-2 WWG	3.40	3.05	2.70	2.25
TIC-3162-2 STG	3.05	2.75	2.45	2.05
TIC-3162-2 WWG	3.50	3.15	2.80	2.35
TIC-3672-2 STG	3.45	3.10	2.75	2.30
TIC-3672-2 WWG	4.00	3.60	3.20	2.68
TIC-4080-2 STG	3.80	3.45	3.05	2.55
TIC-4080-2 WWG	4.45	4.00	3.55	2.95
TIC-4488-2 STG	4.20	3.80	3.35	2.80
TIC-4488-2 WWG	4.85	4.35	3.90	3.20
TI-S100STG	3.20	2.90	2.50	2.20
S-100, VECTOR 8803, CROMENCO, IMSAI, .250 SPACED ROWS				
TI-S100WWG	4.00	3.75	3.50	3.25
S-100 WIRE WRAP				

RS232 and "D" SUB-MINIATURE CONNECTORS





P = Plug, Male Type - S = Socket, Female Type - C = Cover, Hood

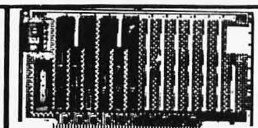
PART NO.	DESCRIPTION	PRICE 1-9	10-24	25-99
CND-DE9P	9 Pin Male	1.70	1.50	1.40
CND-DE9S	9 Pin Female	2.35	2.10	2.00
CND-DE9C	9 Pin Cover	1.50	1.35	1.20
CND-DA15P	15 Pin Male	2.45	2.25	2.10
CND-DA15S	15 Pin Female	3.35	3.20	3.00
CND-DA15C	15 Pin Cover	1.60	1.45	1.30
CND-DB25P	25 Pin Male	2.90	2.70	2.50
CND-DB25S	25 Pin Female	3.75	3.65	3.35
CND-DB51212-1	1 pc Grey Hood	1.50	1.30	1.10
DB-P258C	2 pc Grey Hood	1.45	1.25	1.00
DB1226-1A	2 pc Black Hood	1.90	1.65	1.45
CND-DC37P	37 Pin Male	4.40	4.20	3.90
CND-DC37S	37 Pin Female	6.20	5.95	5.70
CND-DC37C	37 Pin Cover	2.25	2.00	1.75
CND-DD50P	50 Pin Male	5.75	5.45	5.00
CND-DD50S	50 Pin Female	9.65	8.85	8.25
CND-DD50C	50 Pin Cover	2.40	2.20	2.00
D20418-S	Hardware Set 2 pr.	1.00	.80	.70
CND-RS232-8FT	RS232, DB25P, EIA class 1 cable 8 con. 8 ft. long	18.00	16.00	14.00
CND-57-30360	Centronics 700 Series printer connector	9.00	7.50	6.00

ORDER TOLL FREE
1-800-423-5633
except CA., AK., HI., CALL
(213) 894-8171

VCT-8803 Vector MOTHER BOARD FOR S100 BUS MICRO-COMPUTERS

- Kit includes 12 tantalum capacitors for +5, +12, —12 buses and insulated mounting spacers
- Wiring side shown. Component side bare epoxy glass with white markings for component locations
- G10 epoxy glass board with 2 ounce copper, solder plated and .038 diameter holes for leads
- Solder mask with solder windows on etched circuits to avoid accidental short circuits
- Mounts 11 receptacles with 100 contacts (2 rows) on .125 centers with .250 row spacing. Vector part number R681-2, or mounts 10 receptacles plus interconnections to smaller mother board for expansion
- Includes etched circuits and instructions for option of active, pull-up, or floating terminations
- Large buses: +5V and GND (10 AMPS), ± 12V or 16V (7 AMPS). Current ratings are per MIL-STD-275 with 10°C rise
- Fits in Vector pak enclosures
- Fits in IMSAI 8080 microcomputer as expander board

Price: $29.50



VCT8800V
Universal Microcomputer/processor plugboard, use with S-100 bus. Complete with heat sink & hardware, 5.3" x 10" x 1/16"

1-4	5-9	10-24
$21.81	$19.82	$17.82

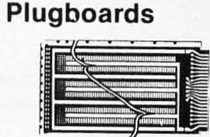
VCT8801-1
Same as 8800V except plain, less power buses & heat sink.

1-4	5-9	10-24
$17.08	$15.65	$14.04

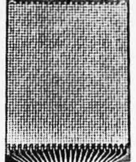
Vector Plugboards



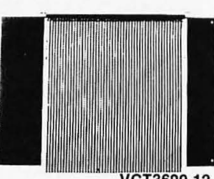
VCT3682 9.6"x4.5" $13.78
VCT3682-2 6.5"x4.5" $10.74
Hi-Density Dual-In-Line Plugboard for Wire Wrap with Power & Grd. Bus Epoxy Glass 1/16" 44 pin. con. spaced .156



VCT3677 9.6"x4.5" $11.71
VCT3677-2 6.5"x4.5" $10.55
Gen. Purpose D.I.P. Boards with Bus Pattern for Solder or Wire Wrap. Epoxy Glass 1/16" 44 pin con. spaced .156



VCT3662 6.5"x4.5" $9.88
VCT3662-2 9.6"x4.5" $12.26
P pattern plugboards for IC's Epoxy Glass 1/16" 44 pin con. spaced .156.



VCT3690-12 CARD EXTENDER
Card Extender has 100 contacts 50 per side on .125 centers-Attached connector is compatible with S-100 Bus Systems........... $27.69
VCT3690 6.5"22/44 pin... .156 ctrs.Extenders. $13.98

ORDER TOLL FREE (800) 423-5633

SEND $1.00 FOR 52 PAGE CATALOG

Circle 285 on inquiry card.



■ Animation Compilier and Graphics Editor Package
■ Add smooth, fast action to basic programs
■ Create ad layouts, newsletter covers, posters

$14.95 Write or call for complete catalog

MACROTRONICS, inc.

1125 N. Golden State Blvd. / Suite G
Turlock, CA 95380 (A)
(209) 667-2888 / 634-8888

We are experiencing telephone difficulties, please keep trying.

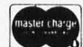
California residents add 6% tax — VISA or MC

Circle 286 on inquiry card.

BASEX is . . .

- More *Basic* than BASIC!
- More *Forthright* than FORTH!
- More *Tiny* than TINY C!
- Runs *Fast* like FORTRAN!
- Less *Hascal* than PASCAL!

***97 page manual ($8) with complete source listing.**
***TAPES ($25) — Meca, SOL, Poly88, TRS80 (16K/II), Paper tape.**
***DISKS — NStar ($25); CPM ($35) 8" SD or 5" (NStar, Meca, MicropII).**
ADD $.75 shipping ($1.50 UPS or special handling)






INTERACTIVE MICROWARE, INC
Box 771, State College, PA, 16801
CALL (814) 238-8294

Circle 287 on inquiry card.

6800/6809 PASCAL

DYNASOFT PASCAL is a cassette based PASCAL subset designed to run on most 6800/6809 systems with 12K or more of memory.

DYNASOFT PASCAL includes most of the control structures of standard PASCAL including IF-THEN-ELSE, CASE-OF-OTHERWISE, WHILE-DO, REPEAT-UNTIL, FOR-TO/DOWNTO-DO, and recursive PROCEDURE's and FUNCTION's. It supports the data types INTEGER, CHAR, BOOLEAN, scalar (user-defined), subrange, pointer and ARRAY. It is built around a one pass compiler which produces fast, compact p-code and comes complete with a line-oriented text editor, p-code interpreter, and program SAVE and LOAD routines. The whole system resides in less than 8K.

The cassette version with manual is priced at $35 plus $3 for postage and handling. Please specify 6800 or 6809.

Dyna soft systems

P. O. BOX 51
WINDSOR JCT., N. S.
CANADA B0N 2V0

Circle 288 on inquiry card.

3M COMPANY / Scotch BRAND

Floppy Discs

Lowest prices. **WE WILL NOT BE UNDERSOLD!!** Buy any quantity 1-1000. Visa, Mastercharge accepted. Call free (800)235-4137 for prices and information. All orders sent postage paid.

PACIFIC EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA
93401. (In Cal call (805) 543-1037.)

Circle 289 on inquiry card.

OHIO SCIENTIFIC

USERS!

Read

PEEK (65)

The Unofficial OSI Users Journal

- User Equipment Reviews
- Hardware Mods
- Software Exchange
- Peeks & Pokes
- Bugs & Fixes

Send $8[00] for 12 issues to:

PEEK(65)
62 Southgate Ave.
Annapolis, MD 21401

Circle 290 on inquiry card.

AURORA, IL. AREA



IDS-440-G PAPER TIGER PRINTER $995[00]

FARNSWORTH COMPUTER CENTER
1891 N. Farnsworth Ave.
Aurora, Il. 60505
Ph. 312-851-3888

Circle 291 on inquiry card.

INDUSTRIAL MICRO SYSTEMS COMPUTER

Desk Top Model With Z80 CPU at 4 MHZ • Dual Double Density 8inch Shugart Floppy with 1.2 M Bytes • 48K Memory with Bank Switching and expandable to 256 K • 2 Serial and 3 Parallel Ports • Transparent Single and Double Density Operation • CPM 1.4 Disk Operating System (Optional) • 90 Days Parts and Labor Warranty • Complete and Ready to Run at $4,250.00
Or a Complete System Including CRT Terminal and Texas Instrument 820 Printer at . . . $7,350.00

Dealer Inquires Invited.

SOO NAM KIM
O S M COMPUTER
2364 WALSH AVE., SANTA CLARA, CA 95051
(408) 496-6910

Circle 292 on inquiry card.

COMPUCOLOR II BACKGAMMON

- Impressive graphics
- Player vs. Computer
- 16K RAM required

diskette $18.00

Blank CCII diskette
$4.50

Same day shipping with money order or send check to . . .

Med Ford Software
419 N. Chapelgate Ln.
Balto., Md. 21229

Dealer inquiries invited

Circle 293 on inquiry card.

THE COMPUTER SHOP, INC.
1000 Pike Road
Birmingham, AL 35218
(205)781-0711

SCOTCH 3M BRAND DISKETTES

Type	Size	Density	Package	Sector	Price/10	Apl.
744-0	5 ¼"	single	storage case	soft	36.00	(1)
744-0	5 ¼"	single	library case	soft	39.00	(1)
740-0	8"	single	storage case	soft	36.00	(2)
741-0	8"	double	storage case	soft	55.00	(3)

(1) for Apple, TRS-80, Pet, SWTP, Cromenco
(2) for IBM 3740 series and compatible drives
(3) for TRS-80 Mod II, Shugart 800/801 and compatible drives

PERSONAL COMPUTING CASSETTES w/leader 10 min $1.95, 30 min $2.30 (10 minimum order)

OTHER SCOTCH BRAND PRODUCTS — Velostat Anti-static Mats, Digital Cassettes, Data Cartridges, Word processing supplies etc. Call or write for pricing.

ANADEX DP8000 PRINTER — 9×7; Upper & lower case; adj. width tractor feed; bidirectional; 1K buffer; expanded print; Parallel, RS232C serial, and Current loop interface. Many more features. $949. Send $2 P & H for a sample printout. (Call or write about the new **9500/9501**).

LOBO Minidisk Drive for TRS-80 — $395

Authorized SCOTCH Minicomputer Distributor

All merchandise is premium grade. Alabama residents add 6%. Foreign orders add 10%. Orders accompanied by payment are shipped at our expense.

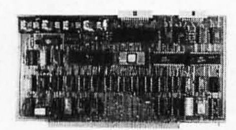



Circle 294 on inquiry card.

DELTA IS READY . . .

Call For DEALER In Your Area

Z-80 CPU



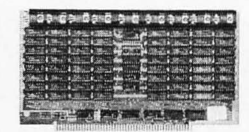
Two serial ports, three parallel ports. 2/4 MHz, on board Prom Monitor Phantoms. (Less cable and Monitor). A & T $325.00

DOUBLE/SINGLE DISK CONTROLLER



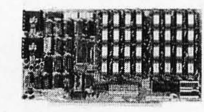
Two stage phase lock loop circuitry for greatest reliability, data transfer at maximum rate. Transparent density selection. 8" or 5" operation 2 or 4 MHZ (Some restrictions on DMA).
DMA — $425.00
STD. — $385.00

16K, 32K STATIC RAM



Worlds most reliable memory, responds to extended address lines A16, A17, cool running, fast.
16K-$395.00 32K-$650.00

32K, 48K, 64K DYNAMIC RAM



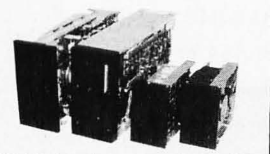
Basic dynamic board tested to run at 4MHZ with our Z-80 board. 4116 chips at 200 nanosecond speed insures most reliable data storage. Double density and DMA compatible.
32K-$580.00 48K-$640.00 64K-$750.00

32K, 48K, 64K ERROR DETECTING Cromenco/ Alfa Micro



State of the art development. Parity generation and error detection. Compatible with 16 bit CPU designs. 16K bank, select under software control. 4MHZ Z-80, 8086, Cromenco, Alpha Micro compatible.
32K-$650.00 48K$725.00 64K-$850.00

FLOPPYS



8" Shugart $550.00
8" Siemans. $525.00
5" Siemans. $350.00
(Double Sided)
8" CDC. $675.00
8" Remex $645.00

TELEVIDEO 912

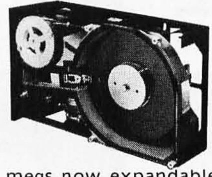
80 x 24—Lower case descenders. Teletype or typewriter keyboard 110/220 VAC. 50 to 19.2K Baud Hex entry pad. Similar to SOROC but better looking with NO FAN NOISE

TELEVIDEO 920



Similar to TV 912 but has programmable functions keys across top. Excellent for WORDSTAR Text Editing.

WINCHESTER/SHUGART SA 1000



5 megs now expandable to 10, works alongside floppy disk drive for expanded storage. Use with controller below.
$1950.00

WINCHESTER/CENTURY DATA SYSTEM (Hunter Shown)



20 megs expandable to 40—Marksman series, plugs into our CPU parallel port or MP/M board drive, cabinet, power supply, 2.0 Bios.
$4850.00

FLOPPY DISKS

DYSAN Quality



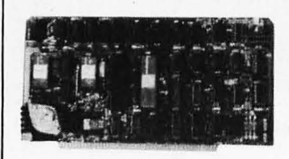
8" SSSD $4.25
8" SSDD $5.50
8" DSDD $7.60
5" SSDD $4.10
(Boxes of 10 only)

MPM® I/O TIMER

Available March 1980

Designed for MP/M® software of Digital Research. 6 users serial port, three 8 bit parallel ports for hard disk. Timer and vectored interrupt.
®TM Digital Research

80 x 24 VIDEO



Keyboard input, Z—80 Processor, on board RAM makes this a non-memory mapped substitute for a terminal when mated with a keyboard.
$430.00

WINCHESTER/FLOPPY INTERFACE

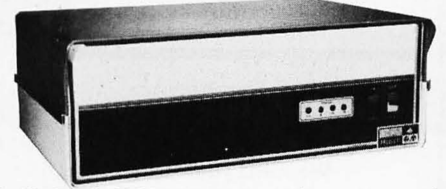
Available March 1980

Allows mixing of Shugart Winchester and floppy drives on same cable when used with DP-DSK. Supplied with software Bios for MP/M® and 2.0
®TM Digital Research

SOFTWARE/ CABLES/PROMS

CP/M® 2.2. . . . . . $150.00
MP/M® $350.00
2708 Monitor . . . $ 25.00
2716 Monitor . . . $ 40.00
Disk 50 Pin . . . . $ 22.00
RS-232 . . . . $ 15.00
CPU to Back. . . . $ 32.00
Disk DC . . . . . . $ 4.50
Disk AC . . . . . . $ 2.50
Winchester . . . . . $ 28.00

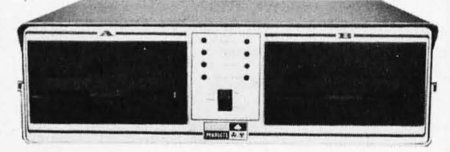
DP S-100 Main Frame



- 12 slot S-100 Motherboard (6 populated)
- +8V @ 20A ±16V @ 6A. (Nylon card guides).
- Mates with disk system shown in center column.
- 3 user convenience outlets at rear.
- Status indicators for I/O wait, memory error, voltage levels.
- Multi-user capable with circuit board selection at top.

Kit (less fans) $295.00 A & T $450.00

Disk Drive Storage



- Cabinet comes with multiple power.
- Supply to suit all popular disk drives ±5A, +24 @ 6A.
- DP-1000K Twin double density Shugart SA-800B or Siemens FDD-100-8 (1 megabyte). $1800.00
- DP-2000K Double sided, double density Shugart SA-850-R or Siemens FDD-200-8 (2 megabytes). $2450.00
- Drive box less drives with ample power supply.

Kit (less fans) $295.00 A & T $450.00

NORTH STAR Competitor



- Cost effective Z-80 dual drive micro system.
- Double density Siemans drives sport 340K single sided, 680K double sided.
- 32K RAM standard, expandable to 64K.
- CPM® 2.0 software included.

$2450.00

West:
DELTA PRODUCTS
15392 Assembly Lane, Unit A
Huntington Beach, Calif. 92649
Tel: (714) 898-1492

Circle 295 on inquiry card.



Telex: 681-367 DELTMAR HTBH

East:
DELTA PRODUCTS
11 Edison Drive
New Lennox, Illinois 60451
Tel: (815) 485-9072

```
TEXAS INSTRUMENT 99/4 COMPUTER         $ 989.
  TI 810 PRINTER                       $1590.
CENTRONIC PRINTERS:
  730-1 PARALLEL PRINTER               $ 749.
  730-2 SERIAL PRINTER                 $ 799.
  779-1 FRICTION FEED                  $ 959.
  779-2 TRACTOR FEED                   $ 999.
COMPRINT 912 APPLE,TRS-80,PAR          $ 559.
         912 SERIAL                    $ 599.
ANADEX WITH PAR & SERIAL INTERFACE     $ 799.
COMMODORE BUSINESS MACHINES:
  PET 2001-8K COMPUTER                 $ 695.
  PET 2001-16K                         $ 895.
  PET 2001-32K                         $1090.
  PET 2022 TRAC. FEED PRINTER          $ 699.
  PET 2023 FRIC. FEED PRINTER          $ 679.
ATARI 800                              $ 889.
      400                              $ 495.
INTERTEC SUPERBRAIN(32K)               $2495.
NORTH STAR COMPUTER AND ACC.
  ** SAVE $  SAVE $ **
DISPLAY TERMINALS:
  INTERTUBE II                         $ 775.
  HAZELTINE 1400                       $ 690.
            1410                       $ 785.
            1500                       $ 990.
IMMEDIATE DELIVERY FROM STOCK.

        MULTI-BUSINESS COMPUTER SYSTEMS
          28 MARLBOROUGH STREET
          PORTLAND, CONN. 06480
            (203) 342-2747
```

Circle 296 on inquiry card.

CROMEMCO SYSTEMS

DISCOUNTED

System 2 with 64k RAM—$3195
System 3 with 64k RAM—$5735

Discounts up to **20%**
on most Cromemco hardware.
We carry the full Cromemco line.

TORREY PINES BUSINESS SYSTEMS

14260 Garden Rd., Suite 1B

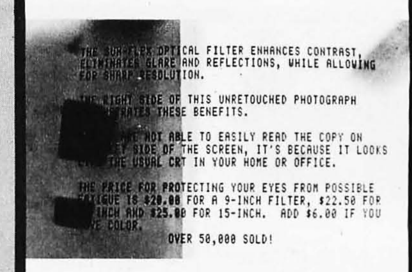
Poway, California 92064

(714) 486-3460

Add 3% for shipping and handling
California residents add 6% sales tax

Circle 297 on inquiry card.

SUN-FLEX OPTICAL FILTER



SUN-FLEX COMPANY, INC.
3020 Kerner Boulevard
San Rafael, CA 94901

(415) 456-8482

Mastercharge/VISA or Check

Circle 298 on inquiry card.

CRANIAL LABS • CRANIAL LABS

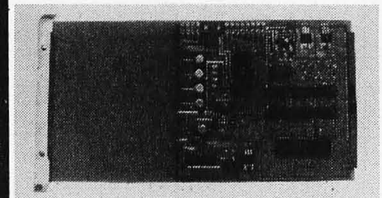
BIORHYTHMS — the Parscience of yourself. Your 3 body cycles till 1990.
EGGSHELL — the ancient game of Math Analysis plus TIC-TAC-TOE in three levels, included in package ***$11.00***

Created for TRS-80 LEVEL II 16K SYSTEMS. Games played with friend or computer.

168 Villa Ave., Buffalo, NY 14216

Circle 299 on inquiry card.

H8 Owners



AD-8/4H
ANALOG/DIGITAL SUBSYSTEM

- **8 A/D Input Channels**
- **Fast-Over 4500 A/D Conversions/Sec**
- **4 D/A Output Channels — Each With Sample and Hold**
- **Full 8 Bit Resolution**
- **Uses Single Card Slot**
- **Fully Assembled And Tested**
- **Full Documentation Provided**
- **Visa, Master Charge OK**

$125.00

CCM, Inc.
P.O. Box 2308 **Reston, Va. 22091**

Circle 300 on inquiry card.

TRS-80 16K LEVEL II

Canadian Income Tax	$29.95
Inventory	49.95
Accounts Receivable	49.95
Banking	19.95
Golf	16.95
Budgeting	19.95
Recipes	19.95

- Mailed on Cassette
- Replacement Guarantee

Use Our Company to Sell Your Programs. Send for information on PROGRAMMERS' PARTICIPATION PLAN.

Want to be on our mailing list? Write us today.

QUADRUS ASSOCIATES

39 Coachwood Road, Brantford, Ontario, Canada N3R 3R5

Circle 301 on inquiry card.

80X24 VIDEOTERM™

7X9 MATRIX DISPLAY FOR
LOWER CASE W/ DESCENDERS APPLE II®



* REGISTERED TRADE MARK OF APPLE COMPUTER INC.

80 columns by 24 lines with easy to read 7x9 dot matrix, upper and lower case with descenders using shift lock feature • 1K firmware incorporates PASCAL and BASIC protocalls so user is not required to enter machine language programs or change PASCALS. Misc. info. or Gotoxy files • Compatible with all APPLE II peripherals so user won't need new software patches for future software products • Crystal controlled dot clock for excellent character stability • VIDEOTERM is the same size as the Apple language card and power consumption is held to a minimum through the use of CMOS and lower power devices • Character set can be user definable up to a maximum of 128 symbols of 8x16 dot matrix font • Display control character mode and four standard display formats controlled by escape sequences • Built in light pen capability • Inverse display mode • 50/60 HZ operation • Sockets on all IC's.

PRICE:Without graphic EPROM $345
OPTIONS: Graphics EPROM line dwg. $25
VIDEO SWITCH PLATE, inserts in case slot to choose between APPLE II* and VIDEOTERM $12
MANUAL: $15



VIDEX 3060 N.W. Thistle Pl. Corvallis, OR 97330 Phone (503) 758-0521

Circle 302 on inquiry card.

COMPLETE S-100 MAINFRAME

$299

Sturdy aluminum enclosure measures 8"H x 17"W x 14"D and includes 6 slot S-100 motherboard with connectors installed, 8 V @ 14 A and ± 16 V @ 2 A power supply, fan, card guides, circuit breaker, reset switch, line filter and connector cutouts.

LOGICON
P. O. Box 1343
Pleasanton, CA 94566
(415) 462-7361

Circle 303 on inquiry card.

We want your

NEW PRODUCTS
to
SELL OVERSEAS

Established European Marketing Organization in the high technology instrumentation field, based in England and with excellent knowledge of the European Market, is seeking to expand its interest in the Consumer and Professional products field by utilizing the unique technological development of the microchip revolution in the U.S.A.

We have the finance, the distribution and the European Marketing expertise and are seeking products with sole European distribution rights. Principals only, please contact Brian Gould, Managing Director, Hampshire Design, Balksbury Hill, Upper Clatford, Andover, Hampshire SP11 7LW, England.

Circle 304 on inquiry card.

Try to beat our prices!

TELEVIDEO TVI-912



Upper case and lower case; 15 baud rates: 75 to 19,000 baud; dual intensity; 24 x 80-char. display, 12 x 10 resolution. Numeric pad. Programmable reversible video; aux. port; self-test mode; protect mode; block mode; tabbing; addressable cursor. Microprocessor controlled; programmable underline; line and character insert/delete.

OUR PRICE ONLY $789

OTHER VIDEO TERMINALS

INTERTUBE II, List $995 . . . ONLY $799
PERKIN-ELMER 550, List $997 . . . . $799
with anti-glare screen, $1027 . . . . . $829
HAZELTINE 1400, List $850 . . . . . $699
1410, List $900 . . . . $749
1420 . . . . $849
1500, List $1225 . . . . $989
1510, List $1395 . . . . $1089
1520, List $1650 . . . . $1389
ADDS R-20, List $995 . . . . $945
LEAR SIEGLER ADM3A, Assembled $849
SOROC 120, List $995 . . . **SPECIAL $729**
IQ140, List $1495 . . . . $1249

PRINTERS

ANADEX 80-col. dot matrix, **SPECIAL $749**
INTEGRAL DATA IP-125 NOW ONLY $689
IP-125 w/1210 option, $838 . . NOW $724
IP-225 w/1210 & 1250 op., List $988 $834
IP-225 w/tractor, 1210, 1250, 1221 (2K Buffer), 1241 (graphics) NOW $899
IDS-440 Paper Tiger, List $995 . . . . . $895
w/graphics op., incl. buffer, $1194 . $989

CENTRONICS
730-1 parallel interface, List $995 . . $779
779-1, Friction Feed, List $1245 949
779-2 w/Tractor, List $1350 1049
702-2 w/Tractor, VFU, List $2480 . 1995
703-2 w/Tractor, VFU, List $2975 . 2395
704-2 w/Tractor, List $2350 1995
COMPRINT 912 w/parallel interf. $559
912 w/serial interface, List $699 589
T.I. 810 Basic Unit, List $1895 . . . . $1695
810/serial & Centronics-style parallel interface, List $1940 1735
810 w/full u/lc ASCII, Vertical Forms Control, Compressed Print . 1895

NORTH STAR HORIZON

HORIZON 1 KITS

16K, Double Density, List $1599 . . $1474
32K, Double Density, List $1849 . . . 1684
32K, Quad Density, List $2049 1869

HORIZON 1 ASSEMBLED & TESTED*

32K, Double Density, List $2695 . . $2279
32K, Quad Density, List $2995 2539

HORIZON 2 KITS

16K, Double Density, List $1999 . . $1824
32K, Double Density, List $2249 . . . 2034
32K, Quad Density, List $2629 2359

HORIZON 2 ASSEMBLED & TESTED*

32K, Double Density, List $3095 . . $2619
32K, Quad Density, List $3595 . . . $3049
48K, Double Density, List $3590 . . . 3039
48K, Quad Density, List $4090 3469
64K, Double Density, List $3830 . . . 3239
64K, Quad Density, List $4330 3669

* Complete w/12 edge connectors, two SIOs, one PIO, and extra drive cable.

FLOPPY DISK SYSTEMS

MORROW THINKER TOYS® Discus 2D, List $1149 . . . . OUR PRICE $979
Discus 2D, dual-drive, List $1948 $1658
Discus 2+2, A&T, List $1549 . . . . $1319
Dual Discus 2+2, A&T, List $2748 . $2335
MICROMATION Megabox, double-density w/ 8" drives, 1-megabyte, List $2295 . $1949
2-megabyte, List $3095 . . . . $2629
MICROPOLIS 1041 MacroFloppy® w/enclosure (no P.S.), List $695 . . . $625
1042 MacroFloppy w/case & AC P.S. 709
1053 Dual MetaFloppy®, List $1895 . 1695

VIDEO BOARDS

I/O Mapped
SD COMPUTER VDB-8024, kit, List $370 $299
Assembled, List $470 . . . . $399
XITEX SCT-100K, Kit . . . . ONLY $154.95
SCT-100A Assembled $174.95
SSM VB2 I/O, Kit, List $169 . . . . $144
Assembled & Tested, List $234 . . . . $199

Memory Mapped
VECTOR GRAPHICS Flashwriter FW2 . . . $313
SSM VB1B, 16x64, Kit, List $155 . . . . $132
Assembled & Tested, List $210 . . . . $178
SSM VB3 80-Char., 4 MHz, Kit, List $399 . $339
4 MHz, A&T, List $464 . . . . $394
INTER SYSTEMS, 16x64, A&T, List 165 . $149

CONVERT YOUR SELECTRIC TO A COMPUTER PRINTER!

Power supply & electronics, A&T. You make only a simple solenoid installation (or have the factory do it). Manufactured by ESCON.
S-100 Interface Version, List $496 . $445
Universal Types:
Parallel — (Centronics format, for TRS-80, Sorcerer, Apple, etc.), List $575 . . $514
RS232 Standard Serial, List $599 . . 534
IEEE-488 (for PET), List $660 584
TRS-80 Cable 25

CPU BOARDS

(assembled unless noted)

NORTH STAR Z80A (ZPB-A/A), $299 $254
CROMEMCO 4 MHz (ZPU-W), List $395 335
4 MHz (SCC-W), List $450 382
VECTOR GRAPHIC Z-80, List $247 . $210
INTERSYSTEMS (formerly Ithaca Audio)
NEW Series II Z-80, 4 MHz, List $395 $349
SSM CB1A 8080 CPU Board, List $219 $186
CB1A Kit, List $159 135
SSM CB2 Z-80 CPU, List $275 . . . . . $234
CB2 Kit, List $210 179
DELTA Z-80, with I/O $239
SD SBC-100, List $350 . . . . $298
SBC-100 Kit, List $295 250
SBC-200, List $400 332
SBC-200 Kit, List $320 272

MEMORY BOARDS

NORTH STAR 16K Dynamic RAM Board, A&T (RAM-16-A/A), List $499 . . . $420
32K A&T (RAM-32/A), List $739 . . . 620
CROMEMCO (16KZ-W), List $595 . . $495
64KZ-W, List $1795 1485
MEASUREMENT SYSTEMS & CONTROLS
Guaranteed performance, incl. labor/parts 1 yr
DM6400 64K Board w/all 64K, $795 . $659
DM4800 with 48K, List $695 589
DM3200 with 32K, List $595 509
DM1600 with 16K, List $495 429
DM0000 with no RAM, $395 349
THE DMB SERIES —
DMB6400 64K Board w/all 64K . . . $859
DMB4800 with 48K 789
DMB3200 with 32K 709
MORROW SuperRAM — all static, all A&T
16K, 4 MHz or 2 MHz, List $349 . . $299
32K, 4 MHz, List $699 629
16K Memory Master, List $399 339
24K Memory Master, List $549 465
INTERSYSTEMS (formerly Ithaca Audio)
8K Static 2 MHz, A&T, List $165 . . $149
8K Static 4 MHz, A&T, List $195 . . . 176
16K Static 2 MHz, A&T, List $475 . . 427
16K Static 4 MHz, A&T, List $495 . . 445
64K Dynamic, List $995 895
CALIFORNIA COMPUTER
16K Static, A&T, List $349.95 . . . . $259

FLOPPY DISK CONTROLLER BOARDS

MORROW Disk Jockey 1, A&T ($213) . $189
Disk Jockey 2D, A&T, List $479 429
SD Versafloppy 1, Kit, List $250 . . . $212
Versafloppy II, DD Kit, List $430 . . . 360
Versafloppy II, DD, A&T, List $350 . . 278
DELTA double density A&T ($385) . . $345
CONDUCTOR, double density A&T . . $269
INTERSYSTEMS (formerly Ithaca Audio)
FDC-2, A&T, List $495 . . . . $439
MICROMATION Doubler, DD, A&T . $399
TARBELL Floppy Disk Interface, Kit . $199
double density, Kit, List $325 295
double density, A&T, List $425 380

SHIPPING & INSURANCE — Add $2 for boards, $5 for Selectric converter, $7.50 for Floppy Disk Systems, $15 for Horizons. Shipped freight collect: Cromemco Systems, Centronics, DEC, NEC, and T.I. printers. Contact us for shipping information on other terminals and printers.

All prices subject to change and all offers subject to withdrawal without notice. Prices in this ad are for prepaid orders. Slightly higher prices prevail for other-than-prepaid orders, i.e., C.O.D., credit card, etc.

—WRITE FOR FREE CATALOG —

MiniMicroMart, Inc.



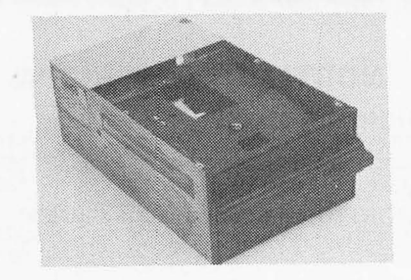
1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

Circle 305 on inquiry card.

FLOPPY DISK DRIVES SYSTEMS

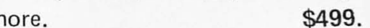
Qume Datatrak

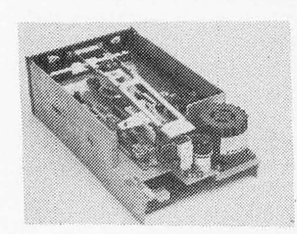
Double sided floppy with NO **HEADACHES.** Although many think this an impossibility, seeing is believing, and this drive is really something! Shugart compatible, fully optioned, reliable, and rapidly becoming the standard in double-sided diskdom.
$599. 2/$549.



Siemens FDD100-8D

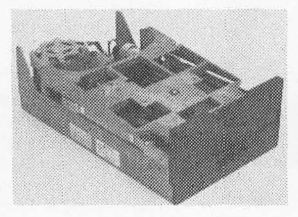
All Siemens options included in this drive, which can be configured hard/soft sector, is Shugart compatible, and not prone to some overheating problems (that other drives are). A highly reliable machine, with write protect, file busy indicator, and more. **$499.**

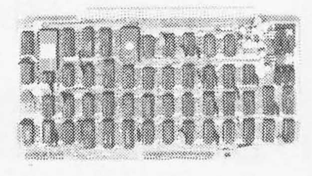


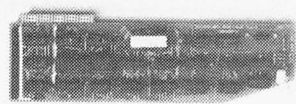


Cal Disk 142M 8"

Built like the proverbial tank. Single/double density, write protect, much more. With Electrolabs' special cabling, it magically becomes Shugart compatible.
Please ask about Cal Dis, enclosure **$389. 2/$379.**
and power supply package bargian.







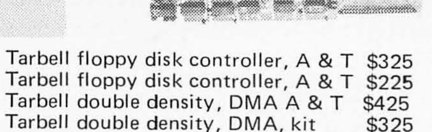


The following 5¼" mini-floppies share most features with their 8" cousins, so without further ado. . .

Siemens FDD 100-5D	$279
Cal Disk Mini	$279
Qume Datatrak 5 (double sided)	$399
BASF Mini mini	$279
SA 400	$299

All the above mini-floppies are fully SA400 compatible.

Manuals for all drives are $10, refundable against future purchase of drives.
Also, all 8" drives can be ordered with 220 v/50 hz for worldwide use.
Moving on to the realm of floppy disk controllers . . . although we still feel that single density is more reliable, there are many excellent double density disk controllers available, so choose your weapons carefully.

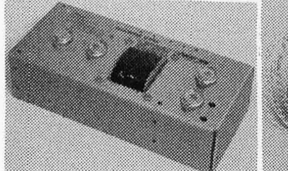


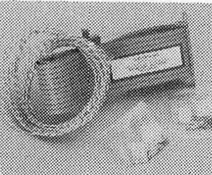
Tarbell floppy disk controller, A & T $325
Tarbell floppy disk controller, A & T $225
Tarbell double density, DMA A & T $425
Tarbell double density, DMA, kit $325

Delta Products double density disk controller
Operate at 2 or 4MHZ, with 8 or 5" drives $399
Micromation doubler w/programmable UART RS-232 port $495
Sorrento Valley single density for Apple $399
Again, purchase price of manuals ($5) is applicable towards future purchase price.

Subtract 15% OFF any Controller with Purchase of 2 Drives.

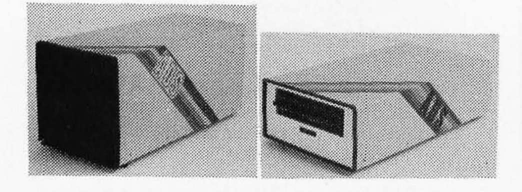
Disk Accessories





Cable kits for 8" drives with 10'50 cond. flat cable, power cable, & all connectors. Assembled if desired. ONe drive 27.5Q, two 33.95, three 38.95 for mini floppies (34 cond): one 24.95, two, 29.95

CP-206 Power-one power supply. Powers two drives more than adequately, top quality. 2.8A/24V, 2.5A/5V, .5A/-5V. **$99.**

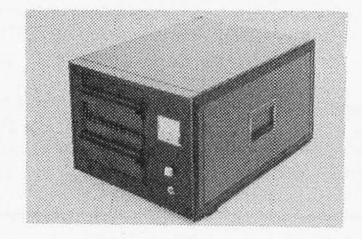


Double disk drive enclosure.
Enclosure alone **$139.**
Including power supply & fan **$199.**

Single disk drive enclosure. Fits all 8" disk drives, please specify make & model No. of drive to assure proper mounting hole positions. Nonmar paint available in blue, beige, silver, & off-while.
Enclosure alone **$60**
Including power supply & fan **$109.**

Electrolabs
POB 6721, Stanford, CA 94305
415-321-5601 800-227-8266
Telex: 345567 (Electrolab Pla)
Visa MC Am. Exp.

ENCLOSURES, SLEEVES



Rackmount Mainframe MT-200. This gorgeous beast is so appealing that it can easily function also as stand-alone mainframe. Very modern styling with fully actively terminated S-100 bus.
Enclosure alone **$399.**
With power supply & fan **$499.**
With 15 slot S-100 bus **$699.**
With two 8" single-sided disk drives **$1,699.**
With two 8" double sided disk drives in place of single-sided variety **$2,299.**

Media



8". . **$39.95**/10 single-sided/single density
8"... **$55.00** single sided/double density
8". . **$55.00** double sided/single density
8". . **$60.00** double sided
8". . specify hard or soft
5 ¼". . **$34.95** single sided
5 ¼". . **$60.00** double sided
Verbatism, Memorex, Scotch,or equivalent name brand
Diskette head cleaning kid for 5¼" or 8" – **$28.75** includes everything for 1 drive for 1 year
Alignment Diskette **$39**
For Floppy Drives

EXTRA SPECIAL !!

Imsai 65K dynamic RAM III

We made a special purchase of this now unavailable board, which were always noted for their fine performance & quality. We have a limited quanity on hand, get your orders in rapidly. These come assembled and tested, with burned-in 200 Ns RAM. Kit 299

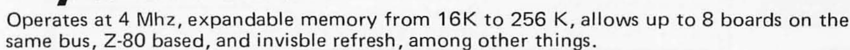
A & T **$399.**

Keyboard Special

CHERRY "PRO" Keyboard **$119.00**
Streamlined Custom Enclosure **$34.95**
BOTH ONLY **$134.95!!!**

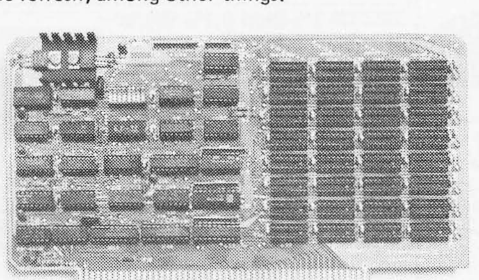
SD Systems Expandoram II

Dynamic RAM



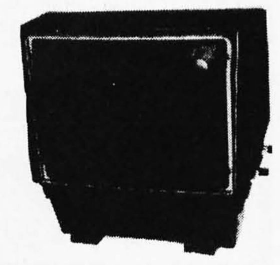
Operates at 4 Mhz, expandable memory from 16K to 256 K, allows up to 8 boards on the same bus, Z-80 based, and invisble refresh, among other things.

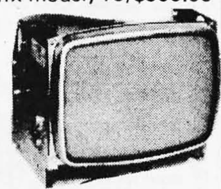
16K kit	**$295.**
16K A & T	**$349.**
32 K kit	**$369.**
32 K A & T	**$419.**
48K Kit	**$440.**
48K A & T	**$490.**
64K kit	**$510.**
64K A & T	**$560.**



Data Display Monitors

Used 12" Sylvania monitors. Composite Video, 15 MHz, 120VAC. Rebuilt with NEW P39 anti-glare tube $89.00
New P4, $89.00, used P4 $69.00
U-fix model, 10/$300.00





"OEM STYLE" as above, will fit any case, (Both versions serviced by qualified tech). Identical to above but subtract $12.00

Televideo 912c $760.

New!

Upper/lower case
Adjustable baud rate – 80 X 24
Editing capabilities – Printer port
Second page memory option



This is a VERY limited extravaganza, so please act quickly

Televideo 920c $860.

Same specs as above, save for special function keys, ideal for text editing and word processing

ELECTROLABS

POB 6721 Stanford CA 94305
(415) 321-5601 (800) 227-8266
Telex: 345567 (Electrolab Pla)

Paper Tiger

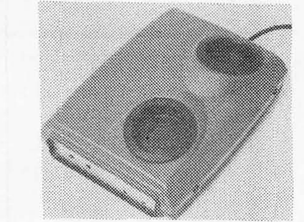
IDS MODEL 440

- 8 Software Selectable Character Sizes
- Parallel & Serial Interface
- 98 ASCII Character set, upper & Lower case
- Forms length control
- Tractor Feed **$899.**

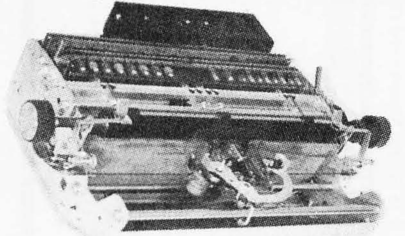
Graphics option with 2K CRT screen buffer add $199.00

Dynamic Devices Modem

- Acoustically coupled modem assembly set
- Asynchrous 0-300 Baud
- Switchable originate or answer modes
- Operates full or half duplex mode
- 15 minute assembly **$129.**
- Novation Cat **$179.**
- Digicomm Coupler **$189.**



Daisy Wheel Printers



Qume Sprint 3\45

PRINTER (factory warr.)	**$1499.**
POWER SUPPLY (Borschert)	**349.**
(Shown mounted on rear of printer)	
COMBINATION SPECIAL	**1699.**
Cases available	**200.**
S-100 interface card	**149.**

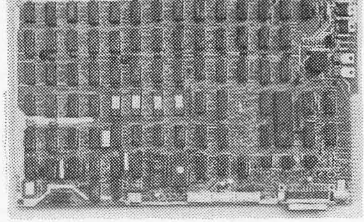
SPRINT 5/45 RO, RS-232
Complete, assembled, in case, plug-in & print, hence, no muss & no fuss **$2699.**

EASTER IC EGG HUNT
(while supply lasts)

2708	$ 8.50	2114	$ 5.99
2716	25.00	2114-2	6.99
2732	95.00	pd411	2.50
2147	12.95	21L02 450 Ns	**1.05**
6502	$ 6.25		
6809	49.00		
6845	39.00		
8085	13.00		
1771	26.95		
1791	37.95		
AY5-1013A	3.95		

UNPRECEDENTED!!!
* 16K Dynamic RAM Set of 8 For: TRS-80, Apple, Exidy, Heath, etc.
* Includes all parts & instructions
* 200 NS **$59.**

Please call for dealer or quantity pricing. Minimum order $20.00
We do custom prom programming.



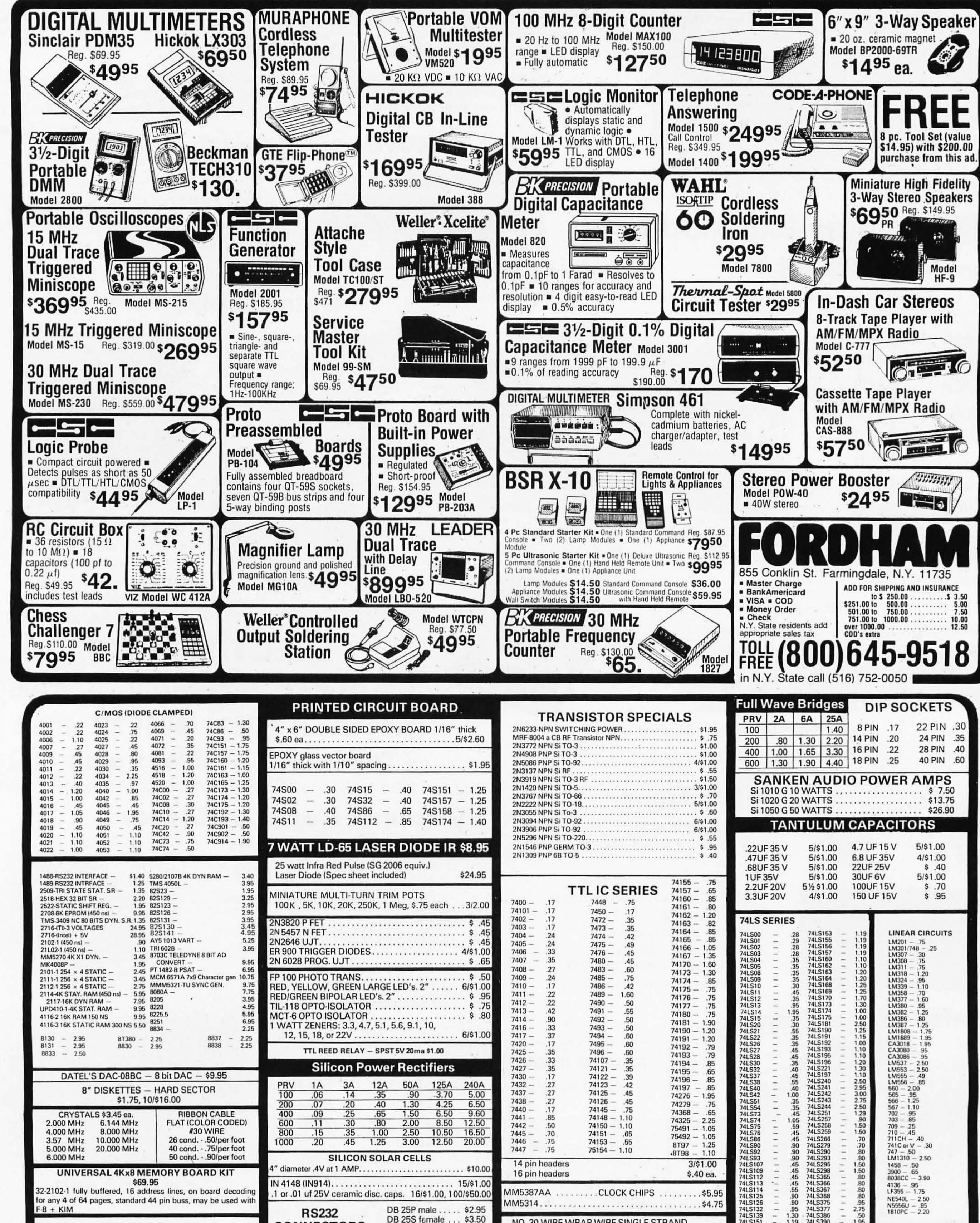
ESAT 200B

BI-LINGUAL 80x24 COMMUNICATING TERMINAL

Scrolling, full cursor, bell, 8x8 matrix, 110- 19,200 baud, Dual Front Applications. Arabic & Hebrew, Multilingual Data Entry Forms Drawing, Music, & Switchyards. **$279.**

Circle 306 on inquiry card.

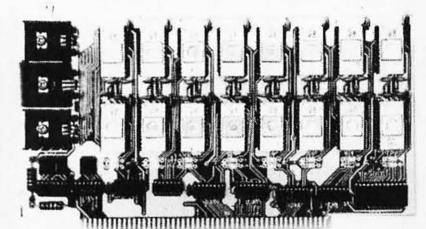
Circle 307 on inquiry card.



Circle 308 on inquiry card.

DIGITAL RESEARCH COMPUTERS
(214) 494-1505

16K EPROM CARD-S 100 BUSS



$59.95 KIT

FIRST TIME OFFERED!
BLANK PC BOARD - $28

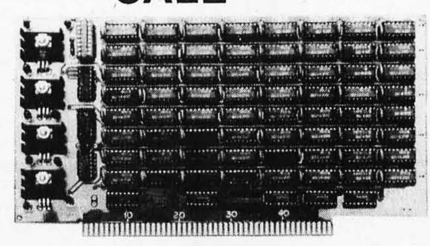
USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450 NS 2708'S ARE $8.95 EA. WITH PURCHASE OF KIT

ASSEMBLED AND FULLY TESTED ADD $30

8K LOW POWER RAM KIT-S 100 BUSS
SALE



PRICE CUT!

$119.50 KIT

21L02
(450 NS RAMS!)

Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

ASSEMBLED AND FULLY BURNED IN ADD $35

ALL ASSEMBLED BOARDS ARE TESTED AT 4MHZ.

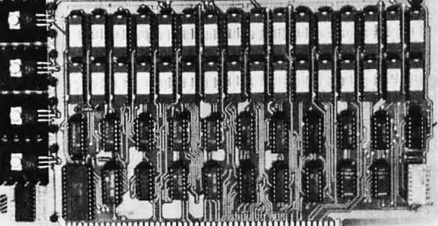
Blank PC Board w/Documentation
$29.95
Low Profile Socket Set...13.50
Support IC's (TTL & Regulators)
$9.75
Bypass CAP's (Disc & Tantalums)
$4.50

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

$225 KIT





KIT FEATURES:
1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard!). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 1.5 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA-$33
LOW PROFILE SOCKET SET-$12
SUPPORT IC'S & CAPS-$19.95
ASSEMBLED & TESTED-ADD $35

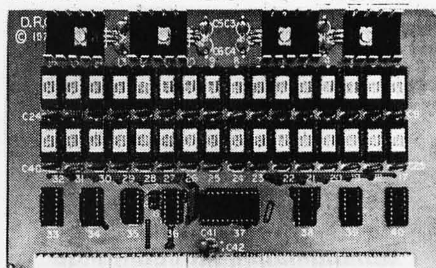
OUR #1 SELLING RAM BOARD!

16K STATIC RAM SS-50 BUSS

PRICE CUT!

$229 KIT

FULLY STATIC AT DYNAMIC PRICES



FOR SWTPC 6800 BUSS!

ASSEMBLED AND TESTED - $35

KIT FEATURES:
1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Runs at Full Speed
4. Double sided PC Board. Solder mask and silk screened layout. Gold fingers.
5. All Parts and Sockets included
6. Low Power: Under 1.5 Amps Typical

BLANK PC BOARD—$26 COMPLETE SOCKET SET—$12
SUPPORT IC'S AND CAPS—$19.95

NEW! STEREO! NEW!
S-100 SOUND COMPUTER BOARD

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

COMPLETE KIT! $84.95 (WITH DATA MANUAL)

BLANK PC BOARD W/DATA $31

KIT FEATURES:
- ★ TWO GI SOUND COMPUTER IC'S.
- ★ FOUR PARALLEL I/O PORTS ON BOARD.
- ★ USES ON BOARD AUDIO AMPS OR YOUR STEREO.
- ★ ON BOARD PROTO TYPING AREA.
- ★ ALL SOCKETS, PARTS AND HARDWARE ARE INCLUDED.
- ★ PC BOARD IS SOLDERMASKED, SILK SCREENED, WITH GOLD CONTACTS.
- ★ EASY, QUICK, AND FUN TO BUILD. WITH FULL INSTRUCTIONS.
- ★ USES PROGRAMMED I/O FOR MAXIMUM SYSTEM FLEXIBILITY.

Both Basic and Assembly Language Programming examples are included.

SOFTWARE:

SCL Interpreter coming soon! Our new Sound Command Language interpreter along with the Register Examine/Modify (REM) routines and Sound Effects Library (SEL) will be available soon in EPROM. SCL makes sound effects programming generally easier and quicker than that written in Basic or Assembly Language. An SCL users group will be formed, and the best new SCL programs submitted will be added to the Sound Effects Library in EPROM.

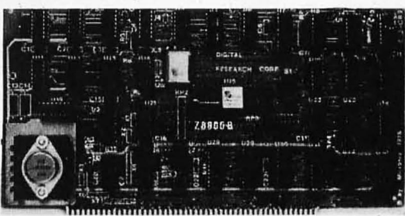
S-100 Z80 CPU CARD

Perfect for OEM's

$169.95

WIRED! NOT A KIT!

4 MHZ



ASSEMBLED AND TESTED! READY TO USE! Over 3 years of design efforts were required to produce a **TRUE** S-100 Z80 CPU at a genuinely bargain price!

BRAND NEW!

FEATURES:
- ★ 2 or 4 MHZ Operation.
- ★ Generates MWRITE, so no front panel required.
- ★ Jump on reset capability.
- ★ 8080 Signals emulated for S-100 compatability.
- ★ Top Quality PCB. Silk Screened. Solder Masked. Gold Plated Contact Fingers.

LOW POWER - 300NS 2114 RAM SALE!

FOR 4MHZ SALE! 8 FOR $44

4K STATIC RAM'S. MAJOR BRAND, NEW PARTS.
These are the most sought after 2114's, LOW POWER and 300NS FAST.
8 FOR $44

NEW! G.I. COMPUTER SOUND CHIP

AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control. 16 Bit Envelope Period Control, 2-8 Bit Parallel I/O. 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy to interface to the S-100 or other busses.
SPECIAL OFFER: $14.95 each Add $3 for 60 page Data Manual.

Digital Research Computers
(OF TEXAS)
P.O. BOX 401565 • GARLAND, TEXAS 75040 • (214) 494-1505

TERMS: Add $1.00 postage. we pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa and MasterCharge. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P & H. 90 Day Money Back Guarantee on all items. Orders over $50. add 85¢ for insurance.

NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE SUPPLIERS OF CPM SOFTWARE.

Circle 309 on inquiry card.

SEX IS NO SUBSTITUTE

for quality software from the Software Review. This months offerings:

SOFTWARE MUSIC SYNTHESIS SYSTEM — *From California Software, this superb 4 voice synthesizer for 8080/Z-80 systems proves that software can do anything hardware can do and it can do it cheaper.*
*For all CP/M & N*DOS systems $79.95*

OSBORNE CBASIC BUSINESS PROGRAMS — *Complete set (A/R, A/P, G/L, Payroll) in most formats (Documentation separate) . . . $100.00*

QUIK-REF — *Definitive Northstar Basic Cross-Reference/Branch trace program. Machine coded for extreme speed $21.50*

DOS-POWER SYS/I — *Machine code module provides additional Northstar DOS capabilities including on-line file recovery, rename, file-locking, directory reformatting, and more $21.50*

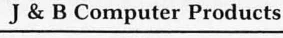
WORDSTAR — *from Micropro. Super word processor Reg. $500 Special offer $400*

KELLY CARD GAMES — *Classic algorithms, STUD, DRAW, ACEY-DUCEY, BLACKJACK Northstar only $21.50*

SUPER PILOT 4.1 — *Acclaimed as the finest Pilot available. Includes tutorials on disk. For Northstar users only $49.95*

ORDER FROM
The Software Review —
704 Solano Ave., Albany, CA 94706
(415) 527-7730

Circle 310 on inquiry card.



We:
Buy — Sell — Trade — Broker,
Mini To Mainframe Computers,
Components to Complete Systems.

We Specialize in Basic Four™

We Supply:
Disc Packs and Cartridges.
Also: Formatted B/4™ Compatible Packs-BBII

We Supply:
Standard and Custom Cable
We Will Be Pleased To Quote *Your* Specs.

Dealer Inquiries Are Invited

J & B Computer Products
P.O. Box 3089 Simi Valley, Calif. 93063
Phone Number Available After Responsible Requests.

Circle 311 on inquiry card.

GAMES —FOR— MICROPOLIS MOD II

At last, software written for MICROPOLIS MOD II using MBASIC operating under MDOS. All games are delivered on a 5¼" floppy disk and include player instructions. M-VENTURE is based on Adventure found on large computer systems. The M-GAMES floppy disk contains 12 of the most popular computer games, including STARTREKM. Both M-VENTURE and M-GAMES are available on a single floppy disk, M-BOTH.

- M-VENTURE $19.95
- M-GAMES $19.95 (Includes STARTREKM)
- M-BOTH $29.95 (Includes M-VENTURE & M-GAMES)

(California residents add 6% sales tax.)

M-SOFTWARE
21215 Merridy Street
Chatsworth, CA 91311

Circle 312 on inquiry card.

SPRINT 68 MICROCOMPUTER

CONTROL COMPUTER DEVELOPMENT SYSTEM

6800 MPU, serial I/O, 48K RAM, dual 8" drives, WIZRD multitasking DOS, Editor, Assembler, 12K BASIC all for $3995.

SOFTWARE OPTIONS
C compiler, PL/W compiler, PASCAL

HARDWARE OPTIONS
EROM Programmer, analog I/O, parallel I/O, 488 GPIB

WINTEK Corp
1801 South Street
Lafayette, IN 47904
Phone: (317) 742-8428

Circle 313 on inquiry card.

JINSAM™ Data Manager

- ★ CUSTOM DATA FILES
- ★ FAST/EASY/MENU DRIVEN
- ★ HELP COMMANDS
- ★ KEYED RANDOM ACCESS
- ★ MULTIPLE SEARCH KEYS
- ★ PRIVACY ACCESS CODES
- ★ WILD CARD SEARCH

For 16K-32K PET, Dual Disk, and Printer

FREE: LABEL PRINTER MODULE
FREE: REPORT GENERATOR MODULE
Specify CBM 2040 or COMPU/THINK

Package **$150** Introductory — **User's Guide** only **$25** — Demo Tape $5 Disk $ 8

Check or Money Order plus $2 Shipping
(NY residents add 8% Sales Tax)
- DEALER INQUIRIES WELCOMED -

JINI MICRO-SYSTEMS, Inc.
P.O. Box 274-B • Bronx, NY 10463

Circle 314 on inquiry card.

HOW CAN I GROW B TREES?

ORDER MICRO B +™

- Get fast insertion, retrieval and deletion of index entries.
- Never need to reorganize your index; no matter how often it is updated.

MICRO B+ SOURCE CODE $195
MICRO B+ DEMO DISK $25
SHIPPING $2 USA, $5 FOREIGN
Available in 8" format for **CBASIC-II** and **MICROSOFT** Basic Version 5.

FAIRCOM
2606 Johnson Drive
Columbia, Mo. 65201
314-445-3304
Check/VISA/Mastercharge

Circle 315 on inquiry card.

PROPERTY MANAGEMENT SOFTWARE

- Full General Ledger
  - user chart of accounts
  - customized statements
- Checkwriter (or manual checks)
- Budgeting
- Rent Roll
- Deliquency List
- Vacancy List
- Lost Rent Report
- Vendor Report
- Lease Expiration Report
- Real Estate Support
  - income property analysis
  - loan amortizations
  - depreciation

Compatable with CP/M, TRS-80, Apple and PET. Demonstration diskette/manual $35.00, full system $650, dealer inquiries welcome. COD, VISA and MasterCharge welcome:

A-T Enterprises
221 N. Lois, La Habra
CA 90631 • 213-947-2762

Circle 316 on inquiry card.

CARD FAMILY 68000

TL Industries

FOR EXORcisor*/ MICROMODULE* BUS:

MIKUL 68000 CPU CARD
Motorola 8 MHz 16 bit processor
4 channel DMA . . . PTM . . . ACIA
7 vectored interrupts

MIKUL 68001 MEMORY CARD
6/12K x 16 PROM . . . 16/32/48K x 16 RAM
68000 a-sync cycle support
***Motorola TM**

ALSO
6809 cards and custom design
TL Industries, Inc., 2573 Tracy Road
Northwood, OH 43619, 419-666-8144
16-BIT CARD FAMILY

Circle 317 on inquiry card.

Quick Service

Competitive Pricing

WABASH

MAXI-MYTE DISKETTES
CONTINUOUS LABELS

STOCK & CUSTOM COMPUTER FORMS

COMPUTER RIBBONS
FREE CATALOG AVAILABLE

GEM Business Systems, Ltd.
60 East 42nd Street
New York, N. Y. 10017
(212) 682-9005

Circle 318 on inquiry card.



FREE! Up to $170 in merchandise with purchase of one of following PET-CBM items ! ! !

Axiom EX-801 PET Printer (with graphics)	$ 475.00
Axiom EX-820 PET Plotter	$ 749.00
Anderson Jacobson 841 Selectric	$1015.00
Leedex Video 100 12" Monitor	$ 119.00
Heath WH19 Terminal (factory asm.)	$ 770.00
Heath WH14 Printer (factory asm.)	$ 735.00
IEEE-RS 232 Printer Adaptor for PET	$ 88.00

BETSI PET to S-100 Interface	$ 119.00
PET Connectors-Parallel or IEEE	$ 1.95
Cassette Port	$ 1.45
Hands on Basic with a PET	$ 10.15
Programming the 6502 (Zaks)	$ 10.45
6502 Applications Book (Zaks)	$ 10.45
6500 Manuals (MOS Technology)	$ 6.50
Programming a Microcomputer: 6502	$ 7.75
6502 Assembly Language (Osborne) NEW!	$ 9.90

PET SPECIALS

		*FREE
PET 16N 16K full size graphics keyboard	$ 995	$130
PET 16B 16K full size business keyboard	$ 995	$130
PET 32N 32K full size graphics keyboard	$1295	$170
PET 32B 32K full size business keyboard	$1295	$170
PET 8N 8K full size graphics keyboard	$ 795	$100
PET 2040 DUAL DISK DRIVE-343,000 bytes	$1295	$170
PET 2022 Tractor Feed Printer	$ 795	$100
PET 2023 Pressure Feed Printer	$ 695	$ 70
PET C2N External Cassette Deck	$ 95	$ 12
Used 8K PETs (limited quantities)	$ 495	

★ **EDUCATIONAL DISCOUNTS** ★
Buy 2 PET Computers, get 1 FREE

*Free Merchandise with Purchase of PET-CBM Item.

KIM-1 $159 (add $30 for power supply) SYM-1	$209
BAS-1 Microsoft ROM Basic for SYM	$ 85
Memory Plus (KIM, SYM, AIM)	$195
SYM Assembler in ROM	$ 85
KIM 16K Static RAM	$284
Seawell Motherboard - 4K RAM Space	$139
KTM-2/80 Synertek Video Board	$349
S-100 16K Static RAM Kit **SALE**	$198
TIS PET Workbooks - set of 6	$ 21.50
Dust Cover for PET	$ 7.45

All Book and Software Prices are Discounted

PET Personal Computer Guide (Osborne)	$ 12.75
PET and the IEEE-488 Bus (Osborne)	$ 12.75
6502 Software Cookbook (Scelbi)	$ 9.45

Cassettes (all tapes guaranteed) AGFA PE611 Premium quality, high out put lownoise in 5 screw housing with labels:

C-10	10/5.65	50/25.00	100/48.00
C-30	10/6.90	50/30.00	100/57.00

2716 EPROM (5 volt)	$29.00	5@ 27.00	10@ 25.00
4116 RAM 16K x 1	$7.50	8 @ 7.10	
2114 L 450	$5.35	20 @ 4.95	80 @ 4.45
2114 L 300	$6.10	20 @ 5.65	80 @ 5.05
6502	$8.35	10 @ 7.85	40 @ 7.35
6522	$7.15	10 @ 6.95	40 @ 6.45
6520	$5.15	10 @ 4.90	40 @ 4.45
6532	$7.90	10 @ 7.40	40 @ 6.85
6502A	$9.50		
6504	$7.95		
21L02	$ .90		
6550 RAM (PET 8K)	$12.70		
S-100 Wire Wrap	$2.85	10 @ 2.65	
S-100 Solder Tail	$2.35	10 @ 2.15	

ATARI — INTRODUCTORY SPECIAL

ATARI 400, Atari 800 and all Atari Modules 20% OFF.

Programmers Toolkit - PET ROM Utilities	$ 44.90
Sargon II (TRS-80 or Apple) NEW!	$ 24.90
Microchess for PET (Peter Jennings)	$ 17.90
Visible Music Monitor (4 Voice) for PET	$ 29.90
KL-4M 4 Voice Music Board (PET)	$ 34.90
CmC Word Processor (8K $25) (16K $34)	
Adventures by Scott Adams	15% Off

SALE

(write for quantity prices)

Scotch 8" Disks	10/$31.00
Scotch 5¼" Disks	10/$31.50
Verbatim 5¼" Disks	10/$26.50
Diskette Storage Pages	10/$ 3.95
Disk Library Cases 8" - $2.95	5" - $2.15
BASF 5¼" Disks	10/$28.00
BASF 8" Disks	10/$29.00



MINIMAX by COMPU/THINK

MINIMAX I (.8 Megabyte Disks) $3395
MINIMAX II (2.4 Megabyte Disks) $4495

SPECIAL — MINIMAX prices include Compu/Think PAGEMATE Database and Report Writer at no charge.

115 E. Stump Road
Montgomeryville, PA 18936
(215) 699-8386
699-5826

A B Computers

WRITE FOR COMPLETE CATALOG
Add $1.00 per order for shipping.
We pay balance of UPS surface charges on all prepaid orders.

DAL-COMP MAIL ORDER DIV.

MODEL 550 "BANTUM" CRT



Interactive CRT terminal with high resolution 12" diagonal 24 × 80 display and a 7 × 10 character matrix. All 128 ASCII characters, highlighted numeric pad, RS-232C interface with eleven switchable baud rates (110 to 9600). Inverse video and transparent modes, switchable parity, full or half duplex and stop bits, absolute and relative cursor control from host computer. 115V, 60Hz.

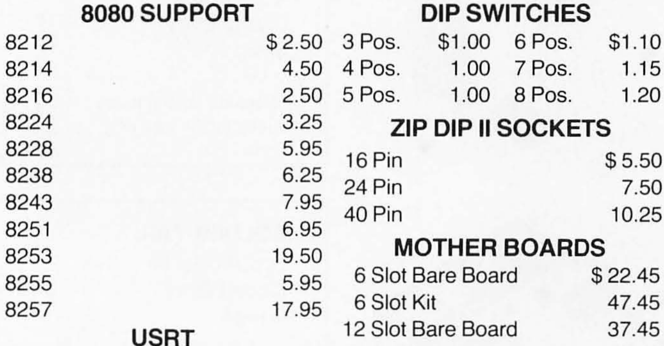
$799.00

DYNAMIC RAMS

4116-250ns 8 for $ 59.95

MICROPROCESSORS

Z80A	$ 13.95
6502	11.95
8035	19.95
8080A	4.95
TMS 9900	29.95



8080 SUPPORT

8212	$ 2.50
8214	4.50
8216	2.50
8224	3.25
8228	5.95
8238	6.25
8243	7.95
8251	6.95
8253	19.50
8255	5.95
8257	17.95

USRT

S 2350 $ 7.95

UARTS

TR 1602 B	$ 3.95
TR 1863	5.95

DISC CONTROLLER

1771	$ 26.95
1791	37.95

PROMS

1702	$ 4.95
2708	7.95
2716—5 Volt	21.95
2758	27.95
2732	85.00

DIP SWITCHES

3 Pos.	$1.00	6 Pos.	$1.10
4 Pos.	1.00	7 Pos.	1.15
5 Pos.	1.00	8 Pos.	1.20

ZIP DIP II SOCKETS

16 Pin	$ 5.50
24 Pin	7.50
40 Pin	10.25

MOTHER BOARDS

6 Slot Bare Board	$ 22.45
6 Slot Kit	47.45
12 Slot Bare Board	37.45
12 Slot Kit	87.45
18 Slot Bare Board	57.45
18 Slot Kit	127.45

RS-232 CONNECTORS

DB25P - Male Plug	$ 2.95
DB25S - Female Socket	3.60
DB25C - Cover	1.50

100% 90 DAY MONEY BACK GUARANTEE ON ALL ITEMS SOLD
SEND $2.00 for 1980 CATALOG

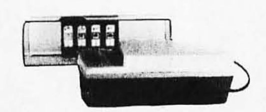
THE STAR MODEM From Livermore



$179.00

0 to 300 baud data rate. Compatible with Bell 103 and 113; CCITT. Answer/Originate. Full/Half Duplex. Special self test features.

EPROM ERASER



Compact, durable, quality UV Lamp for erasing EPROM's. Features a special safety lock to prevent accidental exposure. Erases up to four devices (2708, 2716, 2732, 1702A, 5203Q, 5304Q, etc.) simultaneously.
UV-4/20 $68.95

DAL-COMP MAIL ORDER DIV.

TERMS OF SALE: Cash, checks, money orders, VISA, Master Charge. Minimum order $10.00. Texas residents add 5% sales tax. Minimum shipping and handling charge $2.50. COD orders add $1.15 COD fee. U.S. funds only. D&B rated firms call for open account.

DAL-COMP M/O DIV. 2560 ELECTRONIC LANE, SUITE 108, DALLAS, TEX. 75220 • (214) 350-6895

page

DEAL #1

Hobby Wire Wrap Starter Package



BW2630	WW Tool	$19.95
BT30	#30 Bit	3.95
BC1	Batteries & Charger	14.95
*Kit #1	Wire Kit	9.95
	Regular Price	$48.80

$39.95

*Kit #1 Contains 900 pcs. of precut wire in asst. sizes.

Choose from Red, Blue, White, Black, Green, Orange, Violet, Yellow, or assortment.

DEAL #2

Industrial Wire Wrap Starter Package



BW928BF	WW Tool	$52.95
BT30I	#30 Bit & Sleeve	29.50
BC1	Batteries & Charger	14.95
*Kit #3	Wire Kit	32.95
	Regular Price	$130.35

$119.95

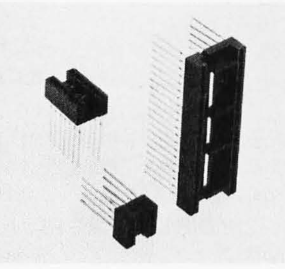
*Kit #2 Contains 4000 pcs. of precut wire in asst. sizes.

Choose from Red, Blue, White, Black, Green, Orange, Violet, Yellow or assortment.

★ ★ BIG DEAL ★ ★

RN IC Sockets by the Tube

RN HIGH RELIABILITY eliminates trouble. "Sidewipe" contacts make 100% greater surface contact with the wide, flat sides of your IC leads for positive electrical connection.



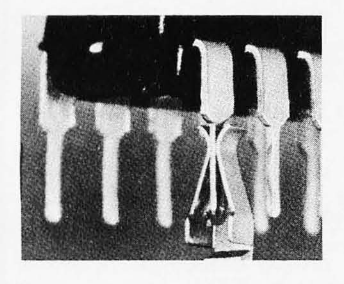
WIRE WRAP SOCKETS

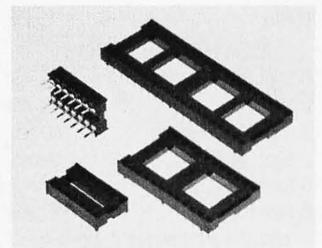
3-level Gold Closed Entry Design

*Sockets sold at these prices by the tube only.

Size	Quantity/Tube	Price ea.*	Price/Tube
08 pin	52	.39	**$20.28**
14	30	.46	**$13.80**
16	26	.50	**$13.00**
18	23	.68	**$15.64**
20	21	.85	**$17.85**
22	18	.42	**$16.56**
24	17	.94	**$15.95**
28	15	1.23	**$18.45**
40	10	1.60	**$16.00**

Above prices include gold up to $800/oz.





SOLDER TAIL

Low Profile Tin Closed Entry Design

*Sockets sold at these prices by the tube only.

1¢/pin (over 5 tubes)

3/4¢/pin (over 100 tubes)

See tube quantities above.

ORDERING INFORMATION

- Orders under $25 include $2 handling
- All prepaid orders shipped UPS Ppd.
- Visa, MC & COD's charged shipping
- All prices good through cover date
- Most orders shipped next day.

Limited to products Page Ditigal stocks. All discounts are off of list price. Call or write for list prices.

10% off on all OK hobby products!
10% off on all Bishop Graphics products!
5% off on all Vector products!

page 135 E. Chestnut Street 5A, Monrovia, California 91016 Phone (213) 357-5005

Circle 328 on inquiry card.

California Digital

Post Office Box 3097 B • Torrance, California 90503

FREE Paper Tiger

With Purchase of The INTEGRAL DATA 440

Your Choice, $200 Value

1) Graphics Option Package
2) Interface for APPLE II
3) TRS-80 Printer Interface

California Digital has resently researched the complete low cost printer market. It is our opinion that the IDS440 Paper Tiger is, without doubt, the most versatile and offers the best value of any printer costing under $1,000.

This quality dot matrix printer incorporates such features as software selectable character size to allow print densities upto 132 characters per line. Full forms handling capabilities and tractor feed mechansim adjustable to 9.5". The Paper Tiger is engineered to accept either parallel or RS232 serial ASCII. 110/220V.50/60Hz.

***** $995.00 plus shipping *****

S-100 Mother Board

Quiet Buss™ $29.95 8803-18 18 slot IMSAI

The Quiet Buss from California Industrial is quality engineered. No short cuts have been taken to produce this mother board. Active termination circuitry prevents noise and crosstalk. Manufactured from extra heavy FR-4 epoxy glass

TELETYPE® MODEL 43



4320 KEYBOARD

TTL	AAA	$1050
RS232....	AAK	1150
Friction...	AAE	1100
103 Modem	AAB	1575

plus shipping

$149 MOTOROLA 12-INCH

New factory surplus. M3000/3211 Motorola CRT monitors.

20 MHz bandwidth Electronics terminate into single ten pin (.156") edge connector. Requires DC power supply

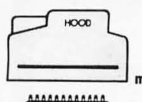
FREE PLASTIC LIBRARY CASE

with purchase of each box of .... Memorex mini-diskettes. $5 value.

$24.95 BOX of 10 DISKETTES

CONNECTORS

RS-232



DB25P male plug & hood $3.95

MALE

DB25S female $3.95

FEMALE

Edge Connectors



GOLD 100 PIN IMSAI/ALTAIR

Imsai solder .125x.250	$2.95	3/$ 7.50
Imsai w/w .125centers	$4.95	3/$13.00
Altair soldertail .140row	$5.95	3/$15.00

SPECIALS

22/44 Kim eyelet.156"	$1.95	3/$5.00
25/50 solder tab .156"	$1.09	3/$2.00
36/72 wide post w/w.156	$1.95	3/$5.00

COMPUTERS

Apple II standard 16K	$988
Apple Plus 16K	988
Atari 400	450
Atari 800	850
Texas Instruments 99/4	895.
Northstar Quad 32k Horizon	2995
Vector MZ	
Compucolor II Model 3	1395
Rockwell Aim 65 (1K)	375

CRT TERMINALS

ADDS Regent 25 (ten key pad)	850
ADDS Regent 40	1195
ADDS Regent 60	1495
Hazeltine 1420	850
Hazeltine 1500	995

MONITORS

Sanyo 9" black & white monitor	179
Leedex Video 100 12"	125
Leedex Video 100-80 12"	179

PRINTERS

IDS440G Tiger with Graphics	$995
Printronix P-300 (300 LPM)	4900
Printronix P-600	
Teletype Model 43 (RS232)	1150
Teletype Model 40(132 col.)	
NEC Spinwriter 5510 R/O	2595
Texas Instruments 810	1650
Centronics 730 friction	695
Centronics 779-2 tractor	995
Centronics 704	1950
Anadex DP8000	895
Anadex DP9500	
Anadex DP9501	
Diablo 1540 R/O plastic wheel	2750
Diablo 1540 KSR plastic wheel	3150

MODEMS

Universal Data Systems LP300 Direct coupled • FCC Approved powered from phone line.	169
Novation Cat Acoustic	169

DISK DRIVES

Shugart SA800R 8" floppy	$449
Shugart SA801R 8" hard sec.	479
Lobo / Two Shugart 801's with power supply and enclosure	1195
One Shugart 801 with power supply and enclosure	795
Lobo hard drive for Apple 10 meg/byte 7710a	3995
Lobo hard drive for TRS80	3995
Lobo 400-t 5 1/4" for TRS80	388
Vista V-80 for TRS80 (40trk)	388
Corvus Systems hard drive	

APPLE COMPATIBLE PRODUCTS

Apple disk drive with controller	560
Apple drive without controller	495
Apple Parallel Interface	179
Ten Key Data Pad for Apple	119
Mountain Hardware Supertalk	279
Mountain / Intro X-10 for BSR	239
***** Memorex Special **********	
8" soft sector diskettes (10)	27
8" double density for TRS80	30

S-100 PRODUCTS

Godbout Rack Enclosure	$289
Godbout Desk Top Enclosure	329
Electronic Controls ECT 100F	250
Cal. Digital 18 slot motherbd.	30

S-100 BOARDS

Think/Toys Switchboard I/O	219
Godbout Econoram Products	
Mullin TB-2 Extend. &Logic	49
Artec WW100 WireWrap Proto	25
SD 64K Expandoram Memory	

16 BIT S-100 BOARDS

Cal. Digital CAL-86	650
Tecmar 8086	650
Seattle Computers 8086	850
Godbout 8088/8085	
Ithaca Intersystems Z-8000	

MISCELLANEOUS

Cherry Pro ASCII Keybd.	129
Maxiswitch HEX Keyboard	49
UV Eraser 11-E	65
Super Mod II RF Modulator	30

Authorized Distributor Scotch Data Products

			10 Pak	50+
740-0	IBM soft format.		$39.00	$3.50
740/2	Double side soft		65.00	6.00
741-0	Double density		53.00	4.90
743-0	Double/Double		70.00	6.60
740-32	8" Hard sector		39.00	3.50
744-(0)(10)(16)	5 1/4"mini		39.00	3.50
Library case for any above;			Add $3.00	
834 A	Data Cassette		5.50	
DC100	Mini Cartridge		16.00	
DC300	Data Cartridge		20.00	
920( )	Disk Cartridge		89.00	

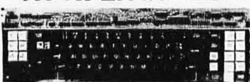
Shugart Associates

SA800-R Floppy Disk Drive

The most cost effective way to store data processing information, when random recall is a prime factor. The SA800 is fully compatible with the IBM 3740 format. Write protect circuitry, low maintenance & Shugart quality.

$449.50

XEROX 800 WORD PROCESSING KEYBOARD ASCII ENCODED



This 77 key word processing keyboard was manufactured by Microswitch for use in the Xerox 800 word processing system.
The keyboard outputs a seven bit ASCII code along with an eighth bit that allows most keys to shift and double function as special characters. Extra large "Tab & Return" keys are designed into the layout of the keyboard to emulate the IBM Selectric. 17 illuminated keys serve for special word processing codes. The keyboard is equipped with two thumbwheel switches for defining line width.
Original Xerox acquisition over $400.00
California Digital USED price only $49.00
Excellent cond. Documentation included.

MEMORY

TRS-80 APPLE II $59

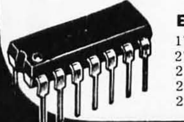
16k memory (8) 4116's

Installation is simple. Anyone who has ever changed a spark plug should be able to up-grade his microcomputer.
How can California Digital offer these memory up-grade sets at 25% below our competition? Simple, we buy in volume, wholesale to dealers and sell the balance directly to owners of personal microsystems. These 16K dynamic memory circuits are factory prime and unconditionally guaranteed for one full year. NOW, before you change your mind, pick up the telephone and order your up-grade memory from California Digital. Add $3 for TRS80 jumpers.

STATIC	1-31	32-99	100-5C	-999	1K+
21L02 450nS.	1.19	.99	.95	.90	.85
21L02 250nS.	1.49	1.39	1.25	*	*
2114 1Kx4 450	5.95	5.50	5.25	4.75	4.50
2114 1Kx4 300	8.95	8.50	8.00	*	*
4044 4Kx1 450	5.95	5.50	5.25	*	*
4044 4Kx1 250	9.95	9.50	9.00	*	*
4045 1Kx4 450	8.95	8.50	8.00	*	*
4045 1Kx4 250	9.95	9.50	9.00	*	*
5257 low pow.	5.95	5.50	5.00	4.80	4.60

SPECIAL CIRCUITS

Z80A 4 MHz.	24.95	AY5-1013A UART	4.95
8080A CPU	9.95	Floppy Disc Controllers	
8085	22.50	WD1771 single D.	39.95
8086 Intel 16bits	85.00	WD1781 Double D	65.00
TMS9900 16bits	49.95	WD1791 D/D 3740	*



EPROMS		1-15	16-63	64+
1702A	2K	4.95	4.50	4.00
2708	8K	9.95	9.50	9.00
2716 5v	16K	29.95	27.50	*
2716 TI		24.88	20.00	*
2532		85.00	*	*

SYSTEM X-10

It's not offen that California Digital ventures into the distribution of consumer products, but we have resently come accross a product that appears so unique that we just had to add it to our product line. This is the System X-10 manufactured by the BSR turntable company. This space age system will remotely control any light or appliance in your home or office. Command signals are transmitted from the command console over your existing wiring. From your bed or easy chair you can control up to 16 different electrical devices inside and outside your home. Use the System X-10 to control your stereo, television or any light fixture on the premises.

The modular system is available in the following components:

Ultrasonic Master Control Console	$34.95
Battery Operated Ultrasonic Controller	19.95
Appliance Module, Lamp Module or Wall Switch.......	13.95

ACOUSTIC MODEM



$89 USED

The Omnitec model 701 Modem connects the RS-232 serial port of your computer or peripheral device acoustically to your telephone line.
Place the telephones handset into cradle of the modem, instantly your computer system has access to the world of digital information.
Half and full duplex ability.

$850 Regent® 25

Through years of research the ADDS Corporation has evolved a low maintenance, extremely durable CRT terminal capable of withstanding an abusive 24 hour duty cycle. The Regent 25 features Intel 8085 microprocessor controlled circuitry along with the Cherry Switch long-life capacitance keyboard.

18 key cursor and numeric pad doubles to allow for user definable special functions. True descending lower case characters along with a fully addressable cursor makes the Regent 25 the ideal word processing terminal.

High-resolution screen is capable of displaying 96 upper and lower case ASCII characters and 32 control codes. This terminal is switch selectable to display six European languages.

At $850 (plus shipping) the Regent 25 offers the best value in todays CRT terminal market. Additional data upon request.

MINIATURE SWITCHES



your choice

	10	50	100	1k
$.98	$.88	.81	.73	.66

SPDT Miniature Toggles

7101 C&K	ON-NONE-ON
7107 jbt	ON-OFF(mnt.ON)
7108 CK	ON-(moment ON)
7103 CK	ON OFF ON
Rotary	3P-4-Pos.
Rotary	3P-6-Pos.
Push B (N.O.)	$.39ea. 4/$1

DIP Switch

	10	25	100	1B
$1.29 ea.	$1.19	1.09	.97	.83

specify 4 7 or 8 pos.

SPST

$139.50 PORTABLE DATA ENTRY SYSTEM



These used data terminals were originally designed for chain store inventory control and order entry systems. The operator enters the inventory control number, merchandise on hand and the unit price. After all pertinent data has been entered into the recorder, the main warehouse is telephoned, the handset is placed in the acoustic coupler and all the recorded information is transmitted back to the master computer. With a little imagination and one of these portable entry systems, you should be able to exchange programs and computer information with associates across the country. All units were removed from service in working condition. Original cost $2,500. Each system comes complete with:

- Portable Cassette Drive Unit
- Removable Entry Keyboard with LED Display
- Five Gould "D" NiCads
- Acoustical Coupler
- Battery Charger
- DB25 Cable
- Shoulder starp
- Full Documentation

DISCOUNT Wire Wrap Center

IC SOCKETS

pin	wire wrap ea.	25	50	low profile ea.	25	50
8	—	—	—	17¢	16	15
14	37¢	36	35	18	17	16
16	38	37	36	19	18	17
24	99	93	85	36	35	34
40	169	155	139	63	60	58

KYNAR WIRE WRAP

50ft. $.98

500	1,000	11,000
$9.	$15.	$105.



Battery wire wrapping tool $34.95

$29.95 BW630

OK HOBBY WRAP-30 wire wrap & strip tool $5.45

(213) 679-9001



master charge

All merchandise sold by California Digital is premium grade. Sorry, no COD's. Orders are shipped the same day received. California residents add 6%. Foreign orders add 10%. Orders over $25, when accompanied by payment, are shipped at our expense. Otherwise, please add $2.

Circle 322 on inquiry card.

ADVANCED COMPUTER PRODUCTS

7400

SN7400N	.19	SN74123N	.59
SN7401N	.22	SN74125N	.39
SN7402N	.22	SN74126N	.44
SN7403N	.22	SN74128N	.59
SN7404N	.22	SN74132N	.69
SN7405N	.23	SN74136N	.95
SN7406N	.23	SN74139N	.95
SN7407N	.23	SN74141N	.69
SN7408N	.26	SN74142N	2.95
SN7409N	.23	SN74143N	2.95
SN7410N	.22	SN74144N	2.95
SN7411N	.29	SN74145N	.62
SN7412N	.29	SN74147N	1.95
SN7413N	.39	SN74148N	1.20
SN7414N	.59	SN74150N	.99
SN7416N	.29	SN74151N	.67
SN7417N	.29	SN74152N	.67
SN7420N	.22	SN74153N	.67
SN7421N	.35	SN74154N	1.19
SN7422N	.29	SN74155N	.82
SN7423N	.29	SN74156N	.89
SN7425N	.29	SN74157N	.69
SN7426N	.29	SN74158N	1.65
SN7427N	.29	SN74160N	.95
SN7429N	.45	SN74161N	.95
SN7430N	.23	SN74162N	.89
SN7432N	.29	SN74163N	.87
SN7437N	.29	SN74164N	.97
SN7438N	.29	SN74165N	.97
SN7439N	.29	SN74166N	1.20
SN7440N	.24	SN74167N	1.95
SN7441N	.79	SN74170N	1.69
SN7442N	.57	SN74172N	5.95
SN7443N	.79	SN74173N	.79
SN7444N	.79	SN74174N	.89
SN7445N	.79	SN74175N	.89
SN7446N	.79	SN74176N	.85
SN7447N	.59	SN74177N	.85
SN7448N	.79	SN74179N	1.80
SN7450N	.23	SN74180N	.75
SN7451N	.23	SN74181N	1.75
SN7453N	.23	SN74182N	.75
SN7454N	.23	SN74184N	1.95
SN7459N	.29	SN74185N	1.95
SN7460N	.23	SN74186N	9.95
SN7470N	.39	SN74188N	3.90
SN7472N	.34	SN74190N	1.15
SN7473N	.38	SN74191N	1.15
SN7474N	.36	SN74192N	.85
SN7475N	.38	SN74193N	.85
SN7476N	.36	SN74194N	.85
SN7479N	4.60	SN74195N	.85
SN7480N	.59	SN74196N	.85
SN7481N	1.10	SN74197N	.85
SN7482N	1.10	SN74198N	1.39
SN7483N	.55	SN74199N	1.39
SN7485N	.65	SN74221N	1.39
SN7486N	.39	SN74251N	.95
SN7489N	1.75	SN74273N	1.05
SN7490N	.39	SN74279N	.89
SN7491N	.65	SN74283N	2.15
SN7492N	.52	SN74284N	3.90
SN7493N	.49	SN74285N	3.90
SN7494N	.72	SN74290N	1.25
SN7495N	.65	SN74298N	.95
SN7496N	.72	SN74365N	.68
SN7497N	3.10	SN74366N	.68
SN74100N	.99	SN74367N	.79
SN74107N	.32	SN74368N	.79
SN74109N	.53	SN74390N	1.90
SN74116N	1.95	SN74393N	1.90
SN74121N	.29	SN74490N	1.90
SN74122N	.39		

CMOS

CD4000	.29	CD4093	.99
CD4001	.29	CD4094	2.95
CD4002	.29	CD4098	2.49
CD4006	1.39	CD4099	2.25
CD4007	.29	MC14408	12.95
CD4008	1.39	MC14409	12.95
CD4009	.59	MC14410	12.95
CD4010	.59	MC14412	12.95
CD4011	.29	MC14415	8.95
CD4012	.29	MC14419	4.95
CD4013	.49	CD4501	.39
CD4014	1.39	CD4502	1.65
CD4015	1.39	CD4503	.69
CD4016	.59	CD4505	8.95
CD4017	1.19	CD4506	.75
CD4018	1.19	CD4507	.95
CD4019	.49	CD4508	3.95
CD4020	1.19	CD4510	1.39
CD4021	1.49	CD4511	1.39
CD4022	1.29	CD4512	1.39
CD4023	.38	CD4515	3.95
CD4024	.79	CD4516	1.69
CD4025	.38	CD4518	1.39
CD4027	.79	CD4520	1.39
CD4028	.99	CD4555	4.95
CD4029	1.29	CD4556	.99
CD4030	.69	CD4566	2.25
CD4031	3.25	74C00	.39
CD4032	2.15	74C02	.39
CD4034	3.25	74C04	.39
CD4035	1.19	74C08	.49
CD4037	1.95	74C10	.49
CD4040	1.29	74C14	1.65
CD4041	1.25	74C20	.39
CD4042	.99	74C30	.39
CD4043	.99	74C32	.99
CD4044	.99	74C42	1.85
CD4046	2.25	74C48	2.39
CD4047	1.25	74C73	.99
CD4048	.69	74C74	.99
CD4049	.69	74C85	2.49
CD4050	.69	74C89	4.95
CD4051	1.10	74C90	1.85
CD4052	1.10	74C93	1.85
CD4053	1.10	74C95	1.85
CD4055	3.95	74C107	1.19
CD4056	2.95	74C151	2.49
CD4059	9.95	74C154	3.50
CD4060	1.39	74C157	2.10
CD4066	.89	74C160	2.39
CD4069	.35	U74CC161	2.30
CD4070	.69	74C163	2.39
CD4071	.35	74C164	2.39
CD4072	.35	74C173	2.59
CD4073	.35	74C174	2.75
CD4075	.35	74C175	2.75
CD4076	1.29	74C192	2.39
CD4077	.35	74C193	2.39
CD4078	.35	74C195	2.39
CD4081	.35	74C922	7.95
CD4082	.35	74C923	6.95
CD4085	1.95	MM80C95	1.50
CD4089	2.95	MM80C97	1.25

74LS00

74LS00N	.35	74LS164N	1.19
74LS01N	.28	74LS165N	.89
74LS02N	.28	74LS166N	2.48
74LS03N	.28	74LS168N	1.89
74LS04N	.39	74LS169N	1.89
74LS05N	.28	74LS170N	1.99
74LS08N	.39	74LS173N	.89
74LS09N	.39	74LS174N	.99
74LS10N	.28	74LS175N	.99
74LS11N	.39	74LS181N	2.20
74LS12N	.39	74LS190N	1.15
74LS13N	.47	74LS191N	1.15
74LS14N	1.25	74LS192N	.98
74LS15N	.39	74LS193N	.98
74LS20N	.26	74LS194N	1.15
74LS21N	.38	74LS195N	.95
74LS22N	.38	74LS196N	.89
74LS26N	.39	74LS197N	.89
74LS27N	.39	74LS221N	1.49
74LS28N	.39	74LS240N	2.99
74LS30N	.26	74LS241N	2.49
74LS32N	.39	74LS242N	2.29
74LS37N	.79	74LS243N	2.29
74LS38N	.39	74LS244N	2.95
74LS40N	.26	74LS245N	8.95
74LS42N	.79	74LS247N	1.10
74LS47N	.79	74LS248N	1.10
74LS48N	.79	74LS249N	1.69
74LS51N	.26	74LS251N	1.79
74LS54N	.35	74LS253N	.98
74LS55N	.35	74LS257N	.98
74LS73N	.45	74LS258N	.98
74LS74N	.59	74LS259N	2.95
74LS75N	.68	74LS260N	.69
74LS76N	.45	74LS261N	2.49
74LS78N	.65	74LS266N	.59
74LS83AN	.99	74LS273N	1.75
74LS85N	1.19	74LS275N	4.40
74LS86N	.45	74LS279N	.59
74LS90N	.75	74LS283N	1.10
74LS92N	.75	74LS290N	1.29
74LS93N	.75	74LS293N	1.95
74LS95N	.88	74LS295N	1.10
74LS96N	.98	74LS298N	1.29
74LS107N	.45	74LS324N	1.75
74LS109N	.45	74LS347N	1.95
74LS112N	.49	74LS348N	1.95
74LS113N	.49	74LS352N	1.65
74LS114N	.55	74LS353N	1.65
74LS122N	.55	74LS363N	1.49
74LS123N	1.19	74LS365N	.99
74LS124N	1.35	74LS366N	.99
74LS125N	.89	74LS367N	.99
74LS126N	.89	74LS368N	.99
74LS132N	.79	74LS373N	2.75
74LS136N	.59	74LS374N	2.75
74LS138N	.89	74LS375N	.69
74LS139N	.89	74LS377N	1.95
74LS145N	1.25	74LS385N	1.95
74LS148N	1.49	74LS386N	.65
74LS151N	.79	74LS390N	1.95
74LS153N	.79	74LS393N	1.95
74LS154N	2.49	74LS395N	1.70
74LS155N	1.19	74LS399N	2.95
74LS156N	.99	74LS424N	2.95
74LS157N	.99	74LS668N	1.75
74LS158N	.75	74LS670N	2.29
74LS160N	.98	81LS95N	1.99
74LS161N	1.15	81LS96N	1.99
74LS162N	.98	81LS97N	1.99
74LS163N	.98	81LS98N	1.99

LINEAR

78H05	5.95	LM1414N	1.90
78M06	1.49	LM1458CN/N	.49
78M.G.	1.49	MC1488N	1.49
LM105H	.99	MC1489N	1.49
LM108AH	2.95	LM1496N	.89
LM300H	.79	LM1556N	1.50
LM301CN/H	.35	LM1800N	.79
LM304H	.98	LM1820N	.95
LM305H	.89	LM1850N	.95
LM306H	3.25	LM1889N	3.95
LM307CN/H	.29	LM2111N	1.75
LM308CN/H	.98	LM2900N	.99
LM309K	1.49	LM2901N	2.50
LM310CN	1.25	LM2917N	2.95
LM311D/CN/H	.98	CA3013T	2.29
LM312H	1.75	CA3018T	1.99
LM317T	2.75	CA3021T	3.49
LM318CN/H	1.49	CA3023T	2.99
LM319N/H	1.25	CA3035T	2.75
LM320K-XX*	1.49	CA3039T	1.49
LM320T-XX*	1.25	CA3046T	1.29
LM320H-XX*	1.25	LM3053N	1.49
LM323K	4.95	CA3059N	3.25
LM324N	1.25	CA3060N	3.25
LM339N	.95	CA3062N	4.95
LM340K-XX*	1.49	LM3065N	1.49
LM340T-XX*	1.25	CA3080N	1.29
LM340H-XX*	1.25	CA3081N	1.69
LM344H	1.95	CA3082N	1.69
LM348N	1.85	CA3083N	1.99
LM358CN	.98	CA3086N	1.29
LM360N	1.49	CA3089N	2.75
LM372N	1.95	CA3096N	2.49
LM376N	3.75	CA3097N	1.99
LM377N	3.75	CA3130T	2.49
LM380CN/N	1.25	CA3140T	2.49
LM381N	1.79	CA3146N	2.49
LM383T	1.95	CA3160T	1.49
LM386N	1.49	CA3190N	1.95
LM387N	1.49	CA3401N	.69
LM390N	1.95	MC3423N	1.49
NE531V/T	3.75	MC3460N	3.95
NE555V	.39	SG3524N	3.95
NE556N	.98	CA3600N	3.50
NE561T	19.95	LM3900N	.59
NE562B	7.95	LM3905N	1.49
NE565N/H	1.25	LM3909N	.98
NE566H/V	1.75	RC4131N	2.95
NE567V/H	1.50	RC4136N	1.10
NE592N	2.75	RC4151N	4.50
LM702H	2.99	RC4194	4.95
LM709N/H	.29	RC4195	4.40
LM710N/H	.98	ULN2001	1.25
LM711N/H	.39	ULN2003	1.50
LM715N	1.95	SN75450N	.59
LM723N/H	.75	SN75451N	.49
LM733N/H	.98	SN75452N	.49
LM739N	1.15	SN75453N	.49
LM741CN/H	.33	SN75454N	.49
LM741CN-14	.19	SN75491N	.89
LM747N/H	.79	SN75492N	.89
LM748N/H	.39	SN75493N	.89
LM760CN	2.95	SN75494N	.89
LM1310N	1.90		

RETAIL STORES OPEN MON-SAT

STORE #1 — 1310 "B" E. Edinger, Santa Ana, CA 92705 — Showrooms, Retail, Warehouse

STORE #2 — 674 El Camino Real, Tustin, CA 92680 — Specializing in Systems

FLOPPY DISK DRIVES

MPI B51-5¼", 40 tracks	279.00
Shugart SA400-5¼" 35 tracks	295.00
Shugart 800/801R 8"	475.00
Siemens Shugart Compatible Model FDD-120-8D	429.00
PERSCI Model 277 Dual	1195.00
WANGO/SIEMENS 5¼" Drive	290.00
MPI B52 5¼" Dual	395.00
WANGO/SIEMENS 282 Dual 5¼"	395.00
WANGO/SIEMENS 82	290.00

HICKOK LX303 $69.95



.5%, 3½ digit 19 Range DVM, ½" LCD displays runs 200 hrs on 1 battery. 10 Meg Ohm Input. 1 yr. guarantee, made in U.S.A., test leads included.

Available Accessories

RC-3 115V AC Adapter	**$7.50**
CC-3 Deluxe Padded Vinyl Carrying Case	**$7.50**
VP-10 X10 DCV Probe Adapter/ Protector 10 Kv	**$14.95**
VP-40 40 Kv DC Probe	**$35.00**
CS-1 10 Amp Current Shunt	**$14.95**

TEXAS INSTRUMENTS INCORPORATED

Calculator Discount Prices

TI 30 SP	17.95
TI 50	39.95
TI 55	35.95
TI 57	54.95
TI 58C	97.95
TI 59	219.95
TI PC 100C	146.95
TI 1035	15.95
TI 1750	19.95
TI 5025	69.95
TI 5040	79.95
TI Data Card	26.95
TI Data Chron	37.95
TI Business Analyst II	42.95
TI Programmer	48.95
TI MBA	57.95
TI Business Card NEW	34.95
TI Speak & Spell	64.95
TI Dataman	19.95
TI Spelling B	27.95
TI Lil' Professor	12.95
TI Vowel Power	12.95
TI Super Stumpers 4, 5, 6	12.95
TI Super Stumpers 7, 8	12.95

MONITORS

Sanyo 9"	$169.95
Sanyo 15"	279.00
Leedex 12"	139.95
Motorola 12", High Resolution, 22 MHz, OEM Model #M3000-340	219.00
Zenith 13" Color Monitor	499.00
MGA 13" Color TV	349.00
VAMP 19" Color Monitor	575.00
VAMP 15" Color Monitor	449.00

TRS-80/APPLE

MEMORY EXPANSION KITS
4116's
16K (200/250 ns.)
8 pcs. for **$62.95**
w/instructions & jumpers.
Call For Volume Pricing

SALE $749.00 HAZELTINE TERMINALS

Model 1400	$749.00	Model 1500	$1085.00
Model 1410	$825.00	Model 1510	$1245.00
Model 1420	$945.00	Model 1520	$1495.00

Continental Specialties

Model 3001 Digital Capacitance Meter	275.00
Model 333 Tri-Mode Comparator	295.00
Model LM-3 40-channel Logic Monitor	585.00
Model LM-1 Logic Monitor	60.00
Model LM-2 Logic Monitor	147.00
Model 2001 Sweepable Function Generator	186.00
Model 5001 Universal Counter-Timer	360.00
Model 6001 650 MHz Frequency Counter	385.00
MAX-100 100 MHz Portable Frequency Counter	149.00
PS-500 500 MHz Decade Prescaler	70.00
MAX-50 50 MHz Handheld Frequency Counter	77.00
MAX-550 550 MHz Handheld Frequency Counter	165.00
Model 4001 Pulse Generator	835.00
Model DP-1 Digital Pulser	83.00
Logic Probes	
Model LP-1 Digital Logic Probe	50.00
Model LP-2 Economy Logic Probe	28.00
Model LP-3 High Speed Logic Probe	77.00
Model LPK-1 Logic Probe Kit	21.95
Logic Probe Accessories	21
Model LTC-1, LTC-2 Logical Analysis Kits	220/250

P.O. Box 17329 Irvine, Calif. 92713
Direct Order Lines: (714) 558-8813
(800) 854-8230 or (800) 854-8241

Apple II. 16K or Apple II. Plus $990

16K Apple Upgrade Kit $62.95

Hi-Speed Serial I/O	$174.95	DS65 Digi-Sector	$349.00	Integer ROM Card	$175.00
Centronics Printer I/O	199.95	Apple Graphics Tablet	795.00	Proto Card	21.95
Applesoft II Firmware	174.95	D.C. Hayes Modem II	349.95	M & R Modulator	29.95
Apple Clock	189.95	Disk II w/Controller	475.00	Sanyo Cassette	54.95
Introl X-10 System	269.95	Disk II	575.00	16K Upgrade Kit	62.95
Introl X-10 Controller	179.95	Pascal Lang. System	475.00	Apple Radio Car	159.00
Alf Music Synthesizer	259.95	Parallel Printer Card	165.00	8" Floppy Controller	350.00
16 Ch. Analog Input	249.95	Communications Card	210.00	Heuristics Speechlab	179.00
2 Ch. Analog Output	164.95	Business Software Pkg.	625.00	Romplus +	169.00
13-Key Keypad	119.95	Corvus 10 Megabyte Drive	4625.00	Supertalker	279.00
Visi-Calc	149.95			Cashier	250.00

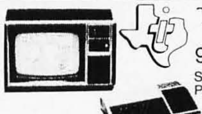
ATARI® 800 & 400

Personal Computer System

ATARI 800 $899.00
ATARI 400 $499.00

ATARI 800 Includes: Computer Console, BASIC Lang. Cartridge, Education System Master Cartridge, BASIC Language Programming Manual, 800 Operator's Manual w/Notebook, Atari 410 Program Recorder, 8K RAM Module, Power Supply, TV Switch Box.

Peripherals		**Education System Cassette Programs**		Spelling	35.00
Disc Drive	599.00	U.S. History	35.00	Basic Electricity	35.00
Printer	499.00	U.S. Government	35.00	Basic Algebra	35.00
Program Recorder	69.00	Supervisory Skills	35.00	**Basic Game and Program Cassettes**	
Software – ROM Cartridges		World History (Western)	35.00	Guide to BASIC Programming	18.00
Education System Master Cartridge	28.00	Basic Sociology	35.00	BASIC Game Programs	19.00
Atari BASIC	55.00	Counseling Procedures	35.00	**Add-On Memory**	
Assembler Debug	55.00	Principles of Accounting	35.00	8K RAM Memory Module	110.00
Basketball	42.00	Physics	35.00	16K RAM Memory Module	225.00
Life	42.00	Great Classics (English)	35.00	**Diskettes**	
Super Breakout™	42.00	Business Communications	35.00	Blank Diskettes	
Music Composer	55.00	Basic Psychology	35.00	Disk File Manager	5.00
Super Bug™	42.00	Effective Writing	35.00	**Accessory Controllers**	
Computer Chess	55.00	Auto Mechanics	35.00	Driving Controller Pair	18.00
Home Finance	55.00	Principles of Economics	35.00	Paddle Controller Pair	18.00
				Joystick Controller Pair	18.00



TEXAS INSTRUMENTS INCORPORATED

99/4 PERSONAL COMPUTER

Superior Color, Music, Sound and Graphics – and a Powerful Extended Basic – All Built In.

$1099.00

commodore PET AS LOW AS $775.00

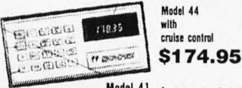


DISCOUNT PRICES

2001-8K	775.00	2023 80-Col Plain Paper Printer	695.00
2001-16KN	975.00	2040 Dual Mini Disk Drive	1250.00
2001-16KB (reg)	975.00	Pet to IEEE Cable	39.95
2001-32KN	1250.00	IEEE to IEEE Cable	49.95
2001-32KB (reg)	1250.00	C2N External Cassette Deck	95.00
2022 80-Col Dot Matrix Printer	795.00		

CompuCruise

Zemco, Inc.



Model 44 with cruise control **$174.95**

Model 41 without cruise control **$154.95**

An onboard navigational computer for automobiles, trucks, and recreational vehicles. Features cruise control, fuel management system, trip computer, multifunctioned quartz crystal time counter, plus many other functions.

Texas Instruments

LANGUAGE TRANSLATOR THAT SPEAKS

The world's first handheld electronic translator to pronounce and display words, phrases and sentences.

Sugg. Ret. 300.00 ACP Price $279.95

LANGUAGE MODULES Sugg. Ret. 60.00
ENGLISH • SPANISH
FRENCH • GERMAN
$54.95 each

HAND HELD COMPUTER SPORTS GAMES

$18.95 EA.



ELECTRONIC **FOOTBALL** ELECTRONIC **SOCCER**

Texas Instruments

ELECTRONIC DIGITAL THERMOSTAT



The Intelligent Way To Cut Energy Costs Year-Round

Use Only The Energy You Really Need – With The Touch Of A Button

The Texas Instruments Electronic Digital Thermostat is the intelligent way to cut energy costs year round. A fully automatic, 24-hour, set and forget comfort system for the home, it can actually pay for itself in less than one season.

Sugg. Reg. 125.00
ACP Price $104.95

SINGLE BOARD COMPUTER SELECTION GUIDE

BOARD	PROCESSOR	ACP PRICE	ENCLOSURE
KIM-1	6502	169.00	Add 29.95
SYM-1	6502	249.00	Add 39.95
Cromemco	Z80	409.00	N/A
SD-SBC100	Z80	239.00	N/A
AIM 65	6502	375.00	Add 49.95
Cosmac Vip	1802	199.00	Inc.

FOR INTERNATIONAL ORDERS:
1401 E. Borchard (714) 953-0604
Santa Ana, CA 92705 TWX: 910-595-1565

ADVANCED COMPUTER PRODUCTS

GET YOUR 1980 CATALOG

FIRST TO OFFER PRIME PRODUCTS TO THE HOBBYIST AT FAIR PRICES!

1. Proven Quality Factory tested products only.
2. Guaranteed Satisfaction
3. Over $1,000,000.00 Inventory

1980 CATALOG NOW AVAILABLE.

Send $2.00 for your copy of the most complete catalog of computer products. A must for the serious computer user.

STATIC RAM BOARDS

Now less than 1½¢ per bit!

- **S-100 32K** (uses 2114)

ASSEMBLED		Kit	
450ns.	499.00	450ns.	469.00
250ns.	539.00	250ns.	499.00

Bare Board 49.95
Bare Board w/all parts less mem. 99.95

- **S-100 16K** (S-100 Compatible) WOW!
  - Low Power
  - 2 MHz or 4 MHz
  - 4K Bank Addressable
  - Extended Memory Management
  - Assembled & Tested

2 MHz **$250.00**
4 MHz **$265.00**

- **LOGOS I 8K**

ASSEMBLED
450 ns. 149.95 KIT 450ns. 125.95
250ns. 169.95 250ns. 149.95
Bare PC Board w/Data $21.95
"Special Offer" Buy (4) 8K 450ns. Kits $117.00

The VISTA V-80 Disk Drive System

- 23% more storage capacity than TRS-80
- 120 day warranty
- 40 track patch at NO CHARGE

Single drive system ...... $ 395.00
Two drive system ...... $ 770.00
Four drive system $1450.00
Two drive cable ...... $ 29.95
Four drive cable ...... $ 39.95

THE VISTA V-200 FOR EXIDY

Price: Starting as low as **$1199.00**

Item	Storage Capacity	Drive Configuration	Shipping Weight	Price
V200 E-20	400	2 Drive Single Head	25 lbs	1199.00
V200 E-22	800	2 Drive Double Head	25 lbs	1549.00
V200 E-30	600	3 Drive Single Head	32lbs	1524.00
V200 E-32	1.2 MEG	3 Drive Double Head	32 lbs	1999.00

DC-500 HARD DISK INTERFACE

CAMEO DATA SYSTEMS INC

- ★ Apple II
- ★ TRS 80
- ★ Cromemco (S-100)
- ★ Others soon

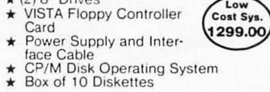
HARD DISK SUBSYSTEM I – $6995.00
– Includes CDC Hawk 10 MB Drive
– Interface of Your Choice

DC-500 Controller – TRS 80 Model I Cables 1500.00
DC-500 Controller – TRS 80 Model II 1500.00
DC-500 Controller – Apple II 1500.00
DC-500 Controller – S-100 1500.00

LOW-COST ADD-ON DISK SUBSYSTEM KIT

- ★ (2) 8" Drives
- ★ VISTA Floppy Controller Card
- ★ Power Supply and Interface Cable
- ★ CP/M Disk Operating System
- ★ Box of 10 Diskettes

Low Cost Sys. 1299.00



IMS STATIC RAM BOARDS $699.00

★ Memory Mapping ★ Low Power
★ Phantom ★ Assembled & tested
Recommended by Alphamicrosystems

	250 ns.	450 ns.
8K Static	$209.00	$189.00
16K Static	$449.00	$399.00
32K Static	$729.00	$629.00

ANADEX PRINTER NEW APPLE VERSION

Model DP-8000 compact, impact, parallel or serial. Sprocket feed, 80 cols, 84 lines/min., bi-directional.
New only $875.00
DP-8000AP (for Apple) $875.00

SD SYSTEMS BOARDS

	KIT	ASSEM
SBC 100 Single Board Computer (2MHz)	$265.00	$ 349.00
SBC 200 Single Board Computer (4MHz)	299.00	399.00
Z80 Starter System	319.00	449.00
VDB 8024 Video Display Board	335.00	459.00
Versa-Floppy II	325.00	429.00
Expando PROM	115.00	225.00
SD100 Computer System w/64K	-	6995.00
SD200 Computer System w/64K	-	7995.00

6800 MICROMODULE™ PRICE LIST

MODEL NO.	DESCRIPTION	PRICE
9600A	Single Board Microcomputer	$495.00
9609	Advanced Single Bd. Comp. (6809)	595.00
9601	16 Slot Mother Board	175.00
9602	Card Cage	75.00
9603	8 Slot Mother Board	100.00
9604	Power Supply	275.00
9605	DC Input Power Supply	325.00
9610	Utility Proto Board	39.00
9611	Arith. Proc/Memory Module	495.00
9612	Buffered Utility Proto Board	49.00
9616	32K EPROM/RAM Module	250.00
9617	EPROM Programming Head	250.00
9620	16 Channel Parallel I/O Module	295.00
9622	Serial-Parallel I/O Module	325.00
9627	16K Static RAM Module 470ns	395.00
9629	32K Static RAM 450ns	695.00
9629A	32K Static RAM 200ns	895.00
9630	Card Extender	68.00
9640	Multiple Programmable Timer	395.00
9650	8 Channel Duplex Serial I/O Mod	395.00
9655	Intelligent Tape Controller	550.00
96103	32/32 I/O Module	275.00
96702	Contact Closure Module	350.00

UNPOPULATED BOARDS (Also Available)

APPLE/EXIDY/EXPANDO TRS 80 16K-UPGRADE KIT

- ★ Special: TRS80 Schematic ...... $ 4.95
- ★ Expansion Interface Schematic .. $ 4.95
- ★ Expansion Interface Connector ... 7.95

EXPANDORAM II MEMORY KITS

★ Bank Selectable ★ Uses 4116 200 ns.
★ Write Protect ★ Power 8VDC, ±16VDC
★ Phantom ★ Up to 4 MHz
Expando 64 Kit (4116)
16K $290.00 48K $444.00
32K $365.00 64K $519.00

LETTER QUALITY SELECTRIC!

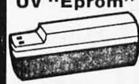
TRENDATA 1000 COMMUNICATION STATION



Supplied with documentation. Power input: 115VAC ± 10%, 60Hz, 200 Watts. Printer platen, 15" wide. Desk size: 20" x 35" wide x 23" deep. Excellent condition. Guaranteed. Shpg. Wt. 150 lbs.

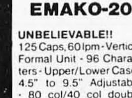
CAT NO. TDP-RE232 .... $1399.00
CAT NO. TDP-TTRS80 .... 1399.00
CAT NO. TDP-EBCDIC 1299.00

UV "Eprom" Eraser



Model UVs-11E $69.95
Holds 4 Eprom's at a time. Backed by 45 years experience.
Model S-52T... $265.00
Professional Industrial Model

EMAKO-20.. Reg. $777.00 $599.00



UNBELIEVABLE!!
125 Caps, 60 lpm - Vertical Formal Unit - 96 Characters - Upper/Lower Case - 4.5" to 9.5" Adjustable - 80 col/40 col double width - Full 96 char. ASCII



EMAKO-22............$799.00

Prints a 132 col/line. Available with parallel or serial output at same price.

MIKA 20..............$1280.00

9x7, 125 cps 136 characters/line
Full 15" width. Super for business applications requiring large IBM format paper.

NEW CENTRONICS 737 PRINTER

Uses any paper roll, fanfold, single sheets, 96 character ASCII, 7 x 7 dot matrix, 50 CPS, RS232 or parallel I/O

WOW! $899.00

Z-80/Z-80A/8080 CPU BOARD

- ★ On board 2708 ★ 2708 included (450ns.)
- ★ Power on jump ★ completely socketed
- ● Z-80 Assembled and Tested $185.00
- ● Z-80 Kit $129.95
- ● Z-80 Bare PC Board .... $ 34.95
- ★ For 4MHz Speed Add $15.00
- 8080A Kit .... $ 99.95
- 8080A Assembled $149.95

S-100 MOTHERBOARD SPECIAL

8 slot expandable w/9 conn.
reg $69.95.................. NOW $52.95

SIEMEN'S FLOPPY SALE

- ● Special buy while supply lasts. — SIEMENS $429.00
- ● 8" Drive with Double-Density — SHUGART 801R
- ● 90 Day Warranty — $475.00

ACOUSTIC MODEM

NOVATION CAT™
0-300 Baud
Bell 103
Answer, Originate $169.00

DATA BOOKS • COMPUTER BOOKS

1980 IC Master	59.95	Intel MCS 80 Manual	7.95
NSC TTL Data	3.95	Intel MCS 40 Manual	4.95
NSC Linear	4.95	AMD 8080A Manual	5.95
NSC Linear App Notes II	3.95	AMD Schottky Databook	4.95
NSC CMOS	3.95	AMI MOS/LSI Data	3.95
NSC Memory	3.95	GI MOS/LSI Data	4.95
Intel Databook	4.95	Harris Analog Databook	4.95
Intel MCS 85 Manual	7.50	TI Linear Control Data	3.95

SALE • OSBORNE BOOKS • SALE

	Reg.	Sale
Intro to Micros Vol. 0	~~8.50~~	7.75
Intro to Micros Vol. I	~~8.50~~	7.75
8080A Programming	~~8.50~~	7.75
6800 Programming	~~8.50~~	7.75
Z80 Programming	~~8.50~~	7.75
Vol. II Some Real Microprocessors w/Binder	~~30.00~~	27.50
Vol. III Some Real Support Devices w/Binder	~~20.00~~	18.50
Intro to Micros Vol. III	~~20.00~~	18.50

SALE • DILITHIUM COMPUTER BOOKS • SALE

Understanding Computers	~~8.95~~	7.95
8080Microcomputer Experiments	~~13.95~~	11.95
Beginning BASIC	~~9.95~~	8.95
Beginners Glossary & Guide	~~6.95~~	5.95
Peanut Butter & Jelly Guide to Computers	~~7.95~~	6.95
8080 Machine Language Programming	~~7.95~~	6.95
Home Computers Vol. I Hardware	~~7.95~~	6.95
Home Computers Vol. II Software	~~13.95~~	11.95
Starship Simulator	~~7.95~~	6.95

MICROPROCESSORS

Z8001 16 bit to 8Mb	$189.00
Z8002 16 bit to 64K	149.00
Z80	**10.75**
Z80A	14.50
F-8 (3850)	16.95
2650	18.95
CD1802	13.95
8080A	8.50
8080A-4MHz	19.95
SALE 8085	**19.95**
8008-1	14.95
2901	9.90
2901A	14.95
2903 4-bit Superslice	29.95
TMS 9900JL	49.95
CP1600	39.95
6502	11.50
6502A	16.95
IM6100	29.95
6800	**11.75**
6800B 2.0 MHz	19.95
6802P	17.95
8035	19.95
8755	49.95
8748	69.95
6809	64.95
8086	69.95

ADVANCED SUPPORT

AM9511 Arith. Processor	175.00
9512 Arith Processor	175.00
9513 Univ. Timing	79.95
AM9517 DMA Controller	18.95
AM9519 Universal Interrupt	18.95

Z-80 SUPPORT CHIPS

Z80-PIO	2.5 MHz	8.75
Z80A-PIO	4.0 MHz	12.95
Z80-CTC	2.5 MHz	8.75
Z80A-CTC	4.0 MHz	12.95
Z80-DMA	2.5 MHz	29.95
Z80A-DMA	4.0 MHz	36.95
Z80-SIO/0	2.5 MHz	35.95
Z80A-SIO/0	4.0 MHZ	39.40
Z80-SIO/1	2.5 MHz	35.95
Z80A-SIO/1	4.0 MHz	39.40
Z80-SIO/2	2.5 MHz	35.95
Z80-SIO/2	4.0 MHz	39.40

8080/8085 SUPPORT

8155/8156 I/O	24.95
8755 I/O with Eprom	64.95
8202 Dyn. Ram Cont.	34.95
8205/74S 138 Decoder	3.95
8212 8 bit I/o	2.75
8214 Priority Int.	5.25
8216 Bus Driver	2.75
8224 Clock Gen.	2.95
8224-4 (4MHz)	9.75
8226 Bus Driver	3.95
8T26 Bus Driver	2.95
8228 Sys. Control	5.50
8238 Sys. Cont.	5.50
8251 Prog. I/O	6.95
8253 Int. Timer	16.95
8255 Prog. I/O	6.50
8257 Prog. DMA	16.95
8259 Prog. Int.	17.95
8275 CRT Controller	59.95
8279 Prog. Keyboard	18.95

6800 SUPPORT CHIPS

6810 128 x 8 Ram	4.75
6820 PIA	5.95
6821 PIA	6.50
6828 Priority Int.	9.95
6834-1 512 x 8 Eprom	16.95
6845/HD46505 CRT Cont.	39.95
6847 Color CRT	49.95
6850 ACIA	5.95
6852 Serial Adapter	5.95
6860 Modem	10.95
6862 Modulator	11.95
6871A 1.0MHz OSC	25.95
6875	8.25
6880 Bus Driver	2.95
MC68488	19.95
68047	24.95

1802 SUPPORT CHIPS

1821 SCD 2K RAM	25.00
1822 SCD 256 x 4 RAM	16.95
1824 CD 32 x 8 RAM	9.95
1852 CD 8 bit I/o	10.95
1854 Uart	10.95
1856 CD I/O	8.95
1857 CD I/O	8.95
1861	12.95

6502 SUPPORT CHIPS

6520 PIA	7.50
6522 Mult	11.95
6530-002,003,004,005	21.95
6532	19.95
6551	19.95

PROMS

2708 450 ns.	8.25
2708-6 650 ns.	7.50
1702A	4.95
2732	74.95
2716-5V	29.95
2716-5V, 12V	29.95
2758-5V	29.95
5203AQ	13.95
5204AQ	14.95
IM 5610	3.90
SALE 8223 32 x 8	**2.95**
82S115 512 x 8 (TS)	16.95
82S123 32 x 8	4.90
82S126 256 x 4	4.90
82S129 256 x 4 (TS)	4.90
82S130 512 x 4 (OC)	6.50
82S23	6.95
82S131	14.95
82S137	14.95

NOTE: WE PROGRAM PROMS

CHARACTER GEN.

2513-001 (5V) Upper	9.50
2513-005 (5V) Lower	10.95
2513-ADM3 (5V) Lower	14.95
MCM6571	11.75
MCM6571A	11.75
MCM6574	14.50
MCM6575	14.50

UARTS/BAUD RATE

TR1602B (5V, 12V)	3.95
AY51013 (5V, 12V)	4.95
AY51014A/1612 (5-14V)	6.95
AY51015A/1863 (5V)	6.95
TMS 6011 (5V, 12V)	5.50
IM6402	7.95
IM6403	8.95
2350 USRT	9.95
1671B Astros	24.95
SALE TR1472B	**9.95**
MC14411	11.95
4702	14.95
WD1941	9.95
COM 5016	16.95

KEYBOARD ENCODERS

AY5-2376	13.75
AY5-3600	13.75
HD0165	9.95
74C922	9.95
74C923	9.95

STATIC RAMS

	1-24	25-99	100
21L02 450ns	1.30	1.25	.99
21L02 250ns	1.59	1.55	1.15
2111	3.75	3.65	3.55
2112-1	2.95	2.85	2.65
2101-1	2.90	2.70	2.55
2114L-250ns (4045)	8.95	7.50	6.50
2114L-450ns. (4045)	5.50	5.25	**4.75**
4044 250 ns	8.95	7.50	6.90
4044 450ns.	5.95	5.95	**4.75**
EMM4200A	9.75	8.75	7.95
EMM4402	7.95	7.25	6.25
EMM 4804	12.50	11.50	9.95
5101C-E	7.95	7.95	7.25
AMD9140/41	10.95	10.25	9.25
AMD9130/31	12.95	11.95	10.25
1101	1.95	1.75	1.25
P2125/93425 (45ns.)	9.95	8.35	8.25
6508 1K x 1 CMOS	7.95	7.95	7.25
5518 1K x 1 CMOS	7.95	7.95	7.25
74S189 64 bit Ram	3.95	3.25	2.50
2147 Low Power 4K Static	19.95	18.95	16.95

DYNAMIC RAMS

416/4116 16K (16 Pin)	8.75
Set of 8 416's	62.95
4115 8K (16 Pin)	6.95
4050 4K x 1 (18 Pin)	4.95
4060 4K x 1 (22 Pin)	4.95
4096 4K x 1 (16 Pin)	3.95
2104 4K x 1 (16 Pin)	4.75
4027 4K x 1 (16 Pin)	4.95

5261	1.95	1103	1.95
5262	1.95	4008L	4.95
5270	4.95	6605	7.95
5280	4.95	6604	4.95
5290	12.45	6002	1.50

64K RAMS $175.00

CHARGE COUPLED DEVICES

16K CCD - First time offered Fairchild 460 CCD 16K Memory (now you can experiment with CCD technology at a reasonable price. 17 page Application note supplied with each order. Quantity limited)

$18.95 each (reg. 43.00)

SOCKETS

# Pins	Lo-Pro Soldertail	Wire Wrap 3 Level Tin	Wire Wrap 3 Level Gold
8	15	32	45
14	19	36	59
16	20	38	62
18	24	59	84
20	29	69	99
22	24	79	1.10
24	38	85	1.20
28	43	1.10	1.49
36	58	1.25	1.69
40	60	1.40	1.89

ZERO INSERTION FORCE

16 Pin $5.50 24 Pin $7.50 40 Pin $10.25

LED READOUTS

PART NO.	SIZE	COLOR	DESCRIPTION	PRICE
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IC SPECIAL PURCHASE

LF 13508 JFET Analog Multi 8 bit	8.95
ICM 7045 Precision StopWatch	23.95
ICM 7205 CMOS LED Stopwatch/Timer	19.95
ICM 7207 Oscillator Controller	7.50
ICM 7208 Seven Decade Counter	18.95
ICM 7209 Clock Generator	6.95
ICL 7107 3½ Digit A/D (LED)	14.95
MC14433P 3½ Digit A/D Converter	13.95
ICL 8211 Voltage Reference	1.95
LM 390N Battery Op. Audio Amp	3/1.00
LM 1800N PLL FM Sterero	3/1.00
LM 1820N AM Radio	3/1.00
LM 1850N Ground Fault IC	3/1.00
LM 2900N Quad Amplifier	2/1.00
LM 2901N (HM) Quad Comparator	2/1.00
LM 2917N Freq. to Volt Conv.	2/1.99
AY-3-3550 4¾ digit DMM	24.95
AY-5-3507 40MHz DVM	9.95
MEM 4963 Mosfet Smoke Detector	11.95
27S08 32 x 8 Prom (IM 5600)	2.95
G115M 6 channel Mosfet	1.49
ULN 2003A 7 channel Driver	.99
10146 1K x 1 ECL Ram	9.95
MCM 14505 64 bit Static Ram	6.95

7520/25	.50	LM 377	1.25
1488/1489	2/1.99	LM 387	1.25
MK5014 Calc.	3/1.99	LM 3302	3/1.99
74S89	3/1.99	LM 4558	3/1.99
78H05K	6.95	RC 4136	2/1.99
LM323K	4.95	RC 4131	2/1.99
MC1372	8.95	COM 5027	39.95
		COM 5037	49.95

PROCESSOR TECHNOLOGY

NKRA Dynamic Memory Boards, Assembled Without RAM, PROM, or Data Delay Line.
Up to 64K per Board $139.95

FLOPPY DISKS

CERTIFIED! 40 TRACKS DOUBLE DENSITY

8" 3740 IBM Compat. $4.39
5¼" Hard 10 Sector $3.99
5¼" Soft Sector 40 Track $3.99
Vista computer diskettes by Verbatim. Minimum order 10. For quantity purchases please call

ALSO AVAILABLE
DOUBLE SIDED DOUBLE DENSITY

PAK OF 10 5¼" $56.40
8" $63.90
Floppy disk hard holes and applicators CALL

FLOPPY DISK I/O

1771-01 8" & Minifloppy	24.95
uPd372 Nec Floppy	49.95
1781 Dual Floppy	29.95
1791-01 Dual Floppy	36.95
uPd 765 Floppy	49.95

A/D CONVERTERS

8700 8 bit Binary	13.50
8701 10 bit Binary	22.00
8703 8 bit TS	13.50
9400 Volt to Freq. Conv.	7.25
8750 3½ Digit BCD	13.95
1408L6 6 bit	3.95
1408L8 8 bit	5.95
DACOI D to A	5.95

TV CHIPS/SOUND

AY38500-1 6 Games B/W	4.95
AY38515 Color Converter	2.95
AY38603-1 Roadrace Game	8.95
AY38605-1 Warfare Game	CALL
AY38606-1 Wipeout Game	9.50
AY38607-1 Shooting Gallery	8.95
AY38910 Sound Generator	12.95
SN76477 TI Sound Generator	3.95
MM5320/21 TV Synch Gen	9.95
MM5369 Prescaler	3.95
LM1889 RF Modulator	3.95
MM57100 NSC Color TV	6.95
MM57104 Clock Gen	3.75
RF Modulator w/Audio	8.95
M&R Modulator	29.95

WAVEFORM GEN.

8038 Function Gen	3.95
MC4024VCO	2.95
LM566 VCO	1.95
XR2206 Function Generator	5.25

SHIFT REGISTERS

MM500H Dual25	.50
MM5056N Dual 256	2.95
MM5060N Dual 128	2.95
2510A Dual 100	1.95
2847 Quad 80	4.95
3341 Dual 80	4.95
3351 40 x 9 FIFO	17.95
3357 Quad 80	6.95
9403 16 x 4 FIFO	24.95
9408 10 Bit Sequencer	9.95

CTS DIPSWITCHES

CTS206-2	1.75	CTS206-7	1.75
CTS206-4	1.75	CTS206-8	1.95
CTS206-5	1.75	CTS206-9	1.95
CTS206-6	1.75	CTS206-10	1.95

CONNECTORS (GOLD)

DB25P (RS232)	3.25
DB25S Female	3.75
Hood	1.25
Set w/Hood. Sale	$7.50
22/44 W/W. S/T. KIM	2.95
43/86 W/W. S/T. MOT	6.50
50/100 S-100 Connector w/w	4.95
50/100 S-100 Connector s/t	3.95

NAKED PC

Z-80 CPU (Ithaca)	$34.95
8080A CPU	34.95
8K Static RAM (Logos)	24.95
16K Static RAM (2114)	29.95
32K Static RAM (2114)	29.95
Floppy I/O (Tarbell)	39.95
Cassette I/O (Tarbell)	29.95
8K Eprom (2708)	24.95
1702 Eprom Board	30.00
2708/2716 Eprom (Ithaca)	34.95
2708/2716 Eprom (WMC)	30.00
Realtime Clock	34.95
ACP Proto Bd (3M Conn.)	27.95
Vector 8800 Proto	22.20
Vector 8803 11 slot MB	29.95
ACP Extender w/Conn	18.95
Video Interface (SSM)	31.95
Parallel Interface (SSM)	31.95
13 Slot MotherBoard (WMC)	32.95
9 Slot MotherBoard (WMC)	29.95
8 Slot Mother (expandable)	34.95
Proc-Tech Bare Boards	CALL

COMPUTER SPECIALS

	LIST	SALE
Apple II Plus w/16K	1195.	990.
PET 2001-16N	995.	895.
Exidy Sorcerer w/16K		1099.
Compucolor II w/8K	1895.	1795.
Cromemco Sys III	6990.	6290.
Horizon I w/32K		CALL
TEI PI208 w/32K dual floppy & CRT	4995.	2495.
Pascal Microengine	1995.	1595.
IPSI 1620 Diablo RO	3295.	2695.
Anadex DP 8000	995.	875.
Centronics Micro P-1	595.	395.
Centronics Micro S-1	595.	525.
Soroc IQ 120	995.	795.
Teletype Model 43	1349.	1150.
HiPlot Plotter	1085.	899.
HiPlot Digitizer	795.	735.
Intertube II	895.	784.
Atari 800	999.	899.
Atari 400	549.	499.
TI 99/4	1150.	1099.
Leedex 12" Monitor	149.	139.
Centronics 737	995.	899.
Trencom T-100	375.	349.
Trencom T-200	595.	525.
Sanyo 9" Monitor	220.	169.
Sanyo 15" Monitor	295.	249.
Motorola 22 MHz Monitor	296.	219.

SOCKET SPECIALS

14 Pin w/w-2L	$ .35
16 Pin w/w-2L	.40
18 Pin w/w-2L	.55
20 Pin w/w-2L	.75
40 Pin w/w-2L	1.45
18 Pin s/t	.15
22 Pin s/t	.15

Call for volume pricing

TERMS: Use check, M/C, VISA, AMEX, CB, or COD. COD requires 25% deposit. Charge Orders please include expiration date. Foreign pay U.S. Funds. Order by phone, mail or TWX. MINIMUM $10.00. Please include magazine issue and phone no. SHIPPING U.S.A. add $2.00 for first 2 lbs. For surface add 30¢ for additional lbs. For air add 70¢ for additional lbs. FOREIGN: Add 10% shipping and handling. COD's $1.85 extra. Not responsible for typos. Some items subject to prior sale. We reserve right to limit quantities, some items subject to precious metal adder. Retail pricing may vary from Mail Order.

RETAIL STORES OPEN MON-SAT

STORE #1 1310 "B" E. Edinger, Santa Ana, CA 92705 — Showrooms, Retail, Warehouse
STORE #2 674 El Camino Real, Tustin, CA 92680 — Specializing in Systems

P.O. Box 17329 Irvine, Calif. 92713
Direct Order Lines: (714) 558-8813
(800) 854-8230 or (800) 854-8241

FOR INTERNATIONAL ORDERS:
1401 E. Borchard (714) 953-0604
Santa Ana, CA92705 TWX: 910-595-1565

Circle 323 on inquiry card.

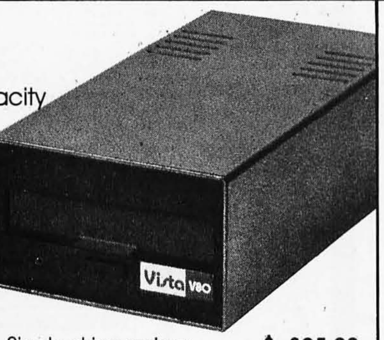
The Supermarket for TRS-80* Add-on Components (and other computers, too)

In stock now. Immediate delivery.

The VISTA V-80 Disk Drive System

- 23%more storage capacity than TRS-80
- 120 day warranty
- 40 track patch at NO CHARGE





Single drive system	$ 395.00
Two drive system	$ 770.00
Four drive system	$ 1450.00
Two drive cable	$ 29.95
Four drive cable	$ 39.95

The VISTA V-80 Expansion Module

- Provides double density modification to your current Radio Shack interface (lets you format diskettes in either single or double density).
- Increases storage capacity up to 204K bytes (on single 40 track drive).
- Includes all hardware

$239.00 and software.



The VISTA Model II

- Provides one, two or three drives.
- Adds up to 1.5 million bytes of on-line storage.
- 120 day warranty
- Does everything Radio Shack's expansion system will do...for less!

$1000.00	Single drive Expansion System
$1550.00	Two drive Expansion System
$2100.00	Three drive Expansion System
$ 525.00	Additional drives alone

The TRS-80 Printers

Centronics 730... **$945.00**
7x7 dot matrix-
80 column

Anadex
DP8000... **$895.00**
9x7 dot matrix-
80 column

VISTA
Printer... **$745.00**
5x7 dot matrix-
80 column

Cables .... **$27.50 each**

Other Products

1. VISTA Verbatim diskettes (hard or soft sector) Certified 40 track .... **$ 38.95**
2. 16K RPM upgrade kits, guaranteed for 120 days. **PRIME PRODUCT** .... **$ 74.50**
3. NEW! DOS + ... **$ 110.00**
4. LNW expansion bare board .... **$ 66.95**
5. H.C. Pennington book, **TRS-80 Disk and Other Mysteries** .... **$ 18.95**
6. DDT Disco-Tech disk drive timer .... **$ 19.95**
7. Cryptext (An Encryption Module) **$299.00**

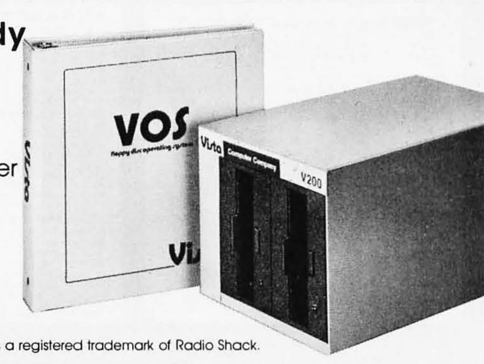
Add On Drives

MPI B51	40 Track, Double Density-204K	**$275.00**
MPI B52	Dual Head, Double Density-408K	**$375.00**
Siemens	FDD100-5 40 Track Double Density 204K	**$275.00**
Siemens	FDD100-5 Flippy, records both sides	**$290.00**
Siemens	FDD100-8 8" Single Sided Drive	**$448.00**

The VISTA V-200 for Exidy

- Completely packaged system, tested and ready to plug in, includes: power supply, two 40 track drives, case, controller, all cabling and total CPM documentation.
- Storage capacity from 400K to 1.2 meg.
- System software-VISTA CP/M Disk Operating System and BASIC-E Compiler recorded on 5-1/4" diskettes.

Price: Starting as low as **$1199.00**





CALL TOLL-FREE 800-854-8017

*TRS-80 is a registered trademark of Radio Shack.

The Vista Computer Company 1401 Borchard Street • Santa Ana, California 92705 • 714/953-0523

Circle 324 on inquiry card.

Unclassified Ads

UNCLASSIFIED POLICY: *Readers who are soliciting or giving advice, or who have equipment to buy, sell or swap should send in a clearly typed notice to that effect. To be considered for publication, an advertisement must be clearly noncommercial, typed double spaced on plain white paper, contain 75 words or less, and include complete name and address information.*

These notices are free of charge and will be printed one time only on a space available basis. Notices can be accepted from individuals or bona fide computer users clubs only. We can engage in no correspondence on these and your confirmation of placement is appearance in an issue of BYTE.

Please note that it may take three or four months for an ad to appear in the magazine.

WANTED: Printer for use with Apple II. Will trade (or sell) Nikon FTN camera with f1.4 lens, Speedlight and Ringlight units, filters, closeup rings, and many other attachments. Write for complete list and send description of printer. Also, will sell Applesoft II read-only memory card for $100 or highest bid. Gene Boggess, Star Route POB 220-6, Columbus MS 39701, (601) 327-6555.

FOR SALE: BYTE, *Kilobaud, Interface Age;* 1977 and 1978 plus some odd issues. Best offer. Les Palenik, 25 Allview Cres, Toronto Ontario, CANADA M2J 2R4.

FOR SALE: 16 DIP (4 K by 1-bit) dynamic programmable memories (a set of eight). Motorola 7839; 250 ns chips. Interchangeable with TMS 4027, Intel 2104A-3, MK 4096-6, and many other brands. In excellent condition, used approximately twenty hours. I upgraded my TRS-80 with 16 K chips. Will sell for $35. Daryl Holder, Rt #2 POB 260-C, Loretto TN 38469, (615) 853-6740 after 4 PM.

FOR SALE: Complete ready-to-go SwTPC system. 6800/1 upgraded to a 6800/2, 28 K, MP-T board, CT-64 in customized cabinet, Hitachi 12-inch with direct video interface, PR-40 with parallel interface, AC-30, JPC TC-3 4800 bps tape interface with CFM/3 operating system. All documentation, assembly instructions, user guides, and source listings included. Software: three BASICs, three Assemblers, two Editors, Disassembler, Tracer, Relocator, games, and more. $1950. Allen Porter, 493 Selfridge Dr, Colorado Springs CO 80916, (303) 574-4146.

FOR SALE: I have four Shugart SA400 disk drives for $285 each and two Shugart SA801 disk drives for $420 each. Need money fast; will take good offer. They work great and were bought in 1979. Four drive cables for $20. David Sparks, 5232 Cornell Ave, Westminster CA 92683, (714) 997-7640.

FOR SALE: 6800 Microprocessor Trainer by Heathkit, Model ET-3400. Includes all manuals, built and tested trainer, programmed learning course (ET-3401), specially built peripheral interface adapter experiment board, and all parts for experiments. $365 value, sell for $315. Excellent condition. James Temple, 24 Spruce Ave, Bethpage NY 11714, (516) 822-6083.

FOR SALE: ESAT 200B 80/24 terminal, $220; GRI 756 keyboard with case, $60; Leedex Video 100 monitor, $100; SD Z80 starter system with 4 K programmable memory, added operating system for video display on 2 K erasable-programmable read-only memory, $260. All assembled, little used, perfect working condition. G Kish, 1621 Payne, Wichita KS 67203, (316) 262-7315.

FOR SALE: Heathkit (Motorola 6800 processor) computer and the Heath H9 video terminal. Computer has 4 K memory expandable to 64 K. Includes BASIC in read-only memory, double-function keypad on computer console, 1 K monitor also with access to memory and processor registers, 8-bit parallel and serial input/output (I/O) with EIA or 20 mA current loop. Cassette interface and cables. Complete documentation and operation manuals. Burned in for one hundred hours. Asking $480. Osi McReynolds, Rt #1 POB 71-B, Coeburn VA 24230, (703) 395-3797.

FOR SALE: PerSci Model 277 dual-diskette drive with a Model 1070 intelligent diskette controller. Capacity ½ megabytes. All books and line diagrams included. Part of a purchased system that was used for six months. James Holle, 9613 W Lincoln Ave, West Allis WI 53214, (414) 541-9808.

FOR SALE: S-100: Vector Graphic 8 K static programmable memory (250 ns), $120. Ithaca Audio Z80A processor (4 MHz), $120. SSM IO-4 (four parallel and two serial ports), $100. SSM PB-1 2708/2716 programmable read-only memory programmer, $110. SSM VB-1B video interface, $100. ECT rack-mount card cage with Thinker Toys Wunderbuss 20-slot mother board and all connectors, $175. All boards assembled and tested, used less than twenty-five hours. Will consider best offer. Send money order to Richard Haendel, 2500 Nonesuch Rd Apt 16-G, Abilene TX 79605, (915) 692-5405.

FOR SALE: PolyMorphic video terminal interface (VTI) board for S-100 systems. Video is spotty, but also can be used as parallel input port (8212 on board) and 1 K programmable memory. Fully socketed, never used, video should be easily fixable. $75 or best offer. Roger Buldain, 601 N Francis, Lansing MI 48912, (517) 337-2278.

FOR SALE: Heathkit ET-3400 Microprocessor Trainer with EE-3401 self-instruction program. Extra memory chips and components. Assembled and in excellent condition. Asking $150. William Porti, Second St, Evans City PA 16033, (412) 538-5454.

WANTED: Program libraries (manuals) for obsolete but working HP-9100A and/or HP-9100B desktop calculators. Thomas H Richardson, Kansas Wesleyan, Dept of Chemistry, Salina KS 67401.

FOR SALE: E-HUH 8100 S-100 bus expansion interface for TRS-80. On-board programmable UART, serial and parallel input/output (I/O), 16 K, 250 ns programmable memory, six card slots. All enclosed in custom metal cabinet with power supply. Full hardware and software documentation. Ready to plug in and turn 16 K system into 32 K. Cables included. Must sell, $700 value only $500. Michael Lesser, 14623 Pine Glen Cir, Lutz FL 33549, (813) 971-8492 nights.

FOR SALE: S-100 system; IMSAI front panel with vector 18-slot mother board, in case with power supply, $200; IMSAI MIO, $100; 8 K WMC Static Mem-1, $100; two 4 K static, $50 each; Ithaca Audio Z80 processor, $125; Cromemco Bytesaver, $125. Above boards operating in system. Tarbell Floppy-Disk Controller, partially assembled, $125; three IBM 8-inch FD33 floppy disks, one complete, one less interface card, and one less motor and interface card, all three for $225. Digitronics high-speed paper tape, with 8-inch autospooler, $100; TDL S-100 case, $20. John Potter, 5439 Eadie Pl, West Palm Beach FL 33407, (305) 686-4666.

FOR SALE: Two Viatron 21s, one robot printer. $500 for three units. Also, SwTPC 6800 and CT-1024, $250. G Ludwig, POB 408, Rice Lake WI 54868, (715) 234-2680.

FOR SALE: Crossassembler for M6800 microprocessor. 4-kilo word program written in BASIC for HP-2000A. Directly usable in other HPs. With simple changes, it assembles languages of other 8-bit microprocessors. Program supports same properties as Motorola's own crossassembler. Program on paper tape, full documentation, user manual, and two-year full support; $163 (includes postage). For manual and documentation, send $3. If required: program in other languages or on other media. Panu Pietikainen, Rauduntie 11 H, SF-02130 Espoo 13, FINLAND.

WANTED: Copy of Z80 Assembler listing from BYTE Nybbles library. Harlan Michael, 315 Valley Vista Dr, Jackson MS 39211, (601) 982-6533 days or (601) 956-5268 evenings.

FOR SALE: Three Heath 4 K by 16 memory boards. All in excellent condition with documentation. $100 each, or all three for $270. Dan Buckler, 6115 A 42nd Pl, Hyattsville MD 20781, (301) 927-0765.

FOR TRADE: Compucolor game programs for other homemade game programs written for the Compucolor II. Programs must be 8 K or less. Paul Weisberg, POB 2453, Melfort Saskatchewan, CANADA S0E 1A0, (306) 752-3566.

FOR SALE: Five new single-board 8080A microprocessors, completely assembled and tested. Each includes 1 K by 8 erasable-programmable read-only memory and 256 by 8 programmable memory. Complete documentation, featured in *CQ* magazine April, May, June 1979. $50 each. Platteter, 1315 Q St, Bedford IN 47421, (812) 279-6265.

WANTED: Ohio Scientific Superboard IIs with all manuals and documentation, up to $150 paid depending on year and condition. Send year and condition for my offer. For Sale: TI 99/4 microcomputer. Paid $1150, first certified check for $1075 gets it. Brand new and still in original carton. Or will trade TI 99/4 for $950 plus Ohio Scientific Superboard II in good condition. Gregg Beasey, 15 Cardinal Ln, East Islip NY 11730.

FOR SALE: Control Data Corp 10 megabytes disk drive for AlphaMicro AM-500 system. Elmer G Mitchell, 1520 18th St, Huntsville TX, (713) 291-3447.

WANTED: I have a small amount of 8080 equipment (processor, a few support chips) and a large supply of other stuff (74xx, MM3501, etc) and would like to buy or trade for anything 6800ish (processor, bareboard, support, etc). Give a hand to an uprooted American. R M Bownes, 146 Warren Rd, Donaghdee County Down, NORTHERN IRELAND BT21 OPQ. PS: Please use airmail, it's a lot faster.

WANTED: Drawings and schematics for making an electrical sleep device, and other schematics for experimental hypnosis. K de Groot, P-Lastmanstr. 7, Helmond, HOLLAND.

WANTED: Heathkit Microprocessor Trainer ET-3400 and Memory I/O Accessory ETA-3400 for use with Heathkit Microprocessor Course. Will trade for Teletype printer parts, and/or cash. Please write and give details (ie: assembled/unassembled and if the unit(s) are operational). George Kelm, POB 160, Yap Island GU 96943. First class mail for fastest reply, US Domestic Post Office rates.

February BOMB Results Graph Theory

Readers of BYTE expressed a burning interest in "A Computer-Controlled Wood Stove" by Steve Ciarcia (page 32). Steve won first place in the voting, his fourth first-place finish in as many months. Second place in the tally went to John A Lehman for "A Financial Analysis Program" (page 192). Judging from comments written on the BOMB cards, many readers were fascinated by an example of the balance sheet for MITS, Inc. Third place was taken by Ted Carter for "Implementing Dynamic Data Structures with BASIC Files" (page 92). Fourth place was taken by Robert A Morris for "Comparison of Some High-Level Languages" (page 128).

Reader Service

*To get further information on the products advertising in BYTE, fill out the reader service card with you name and address. Then circle the appropriate numbers for the advertisers you select from the list. Add a 15-cent stamp to the card, then drop it in the mail. Not only do you gain information, but our advertisers are encouraged to use the marketplace provided by BYTE. This helps us bring you a bigger BYTE. *Correspond directly with company.*

Inquiry No. Page No.

320 AB Computers 329
117 ABW Corp 195
191 Ackerman Digital 259
50 (ADDS) Applied Digital Data Sys 87
323 Adv Computer Prod 332, 333
200 AL Industries 265
267 ALL Electronics 308
83 Altos 142, 143
44 Anadex Inc 79
257 Ancrona 304
109 Anderson Jacobson 184
28 APF Electronics 51
202 Apparat 266
4 Apple Computer 13
76 Applied Computer Sys 132
240 Aristo Polks 294
10 Artec Electronics 24
253 ASAP 302
316 A-T Enterprises 328
244 ATV Research 294
133 Automated Simulations 219
218 Avionic Enterprises (A.E.I.) 275
63 Balcode Software Inc 107
70 BASF 121
271 Beckian 309
195 John Bell Engineering 263
* Beta Computer Devices 253
* Bits Inc 285
150 Bizcomp 238
* The Business & Home Computer Shows 207
* BYTE Back Issues 285
51 BYTE Books 89, 129
230 BYTE Books 279
110 BYTE Conference 185-188
165 C & S Electronics Mart 246
9 California Computer Sys 20, 21
266 California Data Corp 308
322 California Digital 331
214 Cambridge Develop Labs 273
* CBS Records 10
300 CCM Inc 322
118 Central Data 197
18 Chatsworth Data 34
123 Chrislin Industries 206
152 Chrislin Industries 240
* Circle Computer Sales 282
255 Cleveland Consumer Computers & Components 303
196 Compas Microsystems 263
147 Complete Business Systems 235
273 CompuMart 312, 313
72 CompuMax 123
56 CompuServe (microNET) 97
* CompuSystems 49
122 Computer Data Systems 205
* Computer Factory 133
16 Computer Furniture & Access 32
* Computer Headware 254
180 Computer Marketing Corp 253
* Computer Prof Books Club 231
280 Computer Service Center 316
279 Computer Services 316
294 Computer Shop Inc 320
260 Computer Shopper 308
86 Computer Specialties 149
163 Computers Wholesale 246
12 Computex 26
203 CompuView 267
256 Concord Computer Components 304
159 Coosol Inc 244
22 Corvus Systems 41
220 Cover Craft 275
179 CPU Shop 102
299 Cranial Labs 322
1 Cromemco 1, 2
192 CT MicroCOMPUTER, Inc 261
* Cybernetics Inc 248
236 DAR Sales 294
321 Dal-Comp 329
* Data Access 233
213 Data Discount Center 273
228 Datadisk Systems 278
58 Data Management Labs 99
131 Data-Safe Products Inc 214
153 The Datak Corp 241
295 Delta Products 321
175 DG Electronics 249
137 Dennison Kybe Corp 224
265 Des-Mar Electronics 308
106 Diablo (Div of Xerox) 181
124 Digi Byte 80
194 Digital Graphic Systems 261
221 Digital Marketing 276
120 Digital Pathways 201
309 Digital Research: Comp 327
111 Digital Research Corp 189
160 Discount Software Croup 245
198 Dr Dobb's Journal 264
155 Dynacomp 241
288 Dynasoft Systems 320
193 Ecosoft 261
* Electravalue Industrial 294
284 Electrolabs 317
306 Electrolabs 324, 325
54 Electronic Control Tech 93
126 Electronics Book Club 209
245 Electronic Systems 295
246 Electronic Systems 296, 297
215 Escon 273
135 Essex Publishing 222
186 Excel 257
211 EXCOM 271
* Factory Direct Sales 252
315 Faircom 328
291 Farnsworth Computer 320
174 FMG Corp 249
103 Folio Books 174, 175
307 Fordham Radio Supply 326
268 Frederick Computer Prod 308
226 Futureworld 278
107 GW Computers Ltd 182
* Game Design (Taito America) 294
318 GEM Business Sys 328
6 General Business Comp 16
29 Gimix 58
204 Global Parameters 268
104 Godbout Electronics 177
209 GR Electronics Ltd 271
75 H & E Computronics 156
95 H & E Computronics 157
304 Hampshire Design 322
128 Hardside 211
62 D C Hayes Associates Inc 106
141 D C Hayes Associates Inc 228
39 Houston Instruments 71
40 Houston Instruments 71
148 IBC 236
208 Inco Inc 271
* Independent Business Sys 55
34 Industrial Micro Sys 63
330 Infosoft Systems Inc 50
189 INMAC 259
15 Integral Data Systems, Inc 31
190 Integrand 259
426 Intel insert (between pp 16 & 17)
17 Intelligent Systems Corp 33
287 Interactive Microware 320
170 Int'l Data Sciences 248
82 Int'l Data Sys (IDS) 141
41 Intertec 73
* Ithaca Intersystems 9
71 Ithaca Intersystems 122
311 J & B Computer Products 328
259 Jade 306, 307
274 Jameco Electronics 314, 315
314 Jini Microsystems 328
67 Kemco Ltd 115
185 Konan Corp 256
* Lifeboat 116, 117
* Lifeboat 243
303 Logicon 322
169 Lomas Data Products 247
312 M-Software 328
145 Macrotronics 232
286 Macrotronics 320
224 McClintock Corp 277
* Meas Sys & Controls 57
* Meas Sys & Controls 316
293 Med-Ford Software 320
173 MICAH 249
32 Micro Age Computer Stores 61
87 Micro America 150
89 Micro America 151
101 Micro America 171
113 Micro America 191
164 Micro Applications Group (MAG) 246
237 Micro Architect 294
249 Micro Business World 299
329 Microcomputer Tech Inc 266
277 Microcomputer Tech Inc. 316
38 MICRO DATA BASE SYSTEMS 69
136 Micromail 223
261 Micro Mart 308
80 Micro Mike's Inc 137
156 Micro Management Sys 242
* Micro Pro Intl 131
238 Microsette 294
52 Microsoft 91
100 Microsoft (Cons Prod Div) 169
45 Micro Source 81
30 Microtek 59
229 Microware 278
7 The Micro Works 18
49 Micro World 85
171 Midwest Computer Periph 248
247 Mikos 298
187 Mini Computer Suppliers 257
98 Mini Micro Mart 164, 165
105 Mini Micro Mart 179
142 Mini Micro Mart 229
305 Mini Micro Mart 323
326 Morrow/Thinker Toys CV III
8 Mountain Hardware 19
79 Mountain Hardware 136
19 MT MicroSYSTEMS 35
296 Multi Business Comp Sys 322
139 National Multiplex 226
* National Small Comp Show 230
231 NCC (Personal Computing) 281
167 NEBS (New England Business Service Inc) 247
88 NEECO 150
90 NEECO 151
102 NEECO 171
114 NEECO 191
115 Netronics 193
116 Netronics 193
121 Netronics 203
14 North Star 29
283 Northwest Computer Serv 316
327 Ohio Scientific Instrument CV IV
46 OK Machine and Tool Corp 82
85 OK Machine & Tool Corp 147
188 OK Machine & Tool 257
219 The Old Association 275
* OnComputing 289
68 Orange Micro 118
74 Oregon Software 128
132 Osborne/McGraw-Hill 215
292 OSM Computer 320
* Owens Associates 198
262 Pacific Exchanges 308
289 Pacific Exchanges 320
328 Page Digital 330
176 PAIA 251
250 Pan American Elect 300 (A Radio Shack Auth Sales Ctr)
127 PCD Systems Inc 210
290 PEEK (65) 320
5 Per Com Data 15
37 Per Com Data 67
43 Per Com Data 76 & 77
97 Personal Computers 161
99 Personal Software 167
* Phase One Systems 227
168 Pickles & Trout 247
184 Potomac Micro Magic 255
55 Power One 95
285 Priority One 318, 319
92 Prodigy 153
119 Program Design Inc (PDI) 199
81 The Program Store 139
84 QC Microsystems 145
21 QT Computer Sys Inc 39
272 QT Computer Sys Inc 310, 311
301 Quadrus Associates 322
47 Quasar Data Products Inc 83
59 Quay Corp 101
42 Quiet Designs Inc 75
252 Quest 301
91 R & K Enterprises 152
66 RACAL — Milgo 113
201 Racet Computes 265
258 Radio Hut 305
33 Raygam 62
96 RCA 159
77 RCA Solid State 134
172 Reliable Comp Resources 248
275 Renaissance Sys Inc 316
2 RITAM International 8
239 RLK Software 294
129 RNB Enterprises 212
182 Robotics Age 255
225 S-100 277
263 S & A Data Sys 308
149 Howard W Sams Co Inc 237
177 Sara-Tech 251
223 SC Digital 277
227 SCDP 278
* SCION CORP 5
65 Seattle Computer Prod 109
205 Selanar 269
212 Michael Shrayer Software 273
* Shopsmith 204
* Shugart 6, 7
158 Sigma International 243
183 Sigma International 255
178 Sirius Systems 251
134 Small Business Applications Inc 221
* Small Business Sys Group 158
161 Ed Smith's Software Works 245
24 Smoke Signal Broadcasting 45
25 Smoke Signal (Dealers only) 45
48 Softagon Inc 84
112 Softech 190
138 Softside 225
151 The Software Exchange 239
234 Software Factory 284
264 The Software Farm 308
310 The Software Review 328
217 Software Works 275
308 Solid State Sales 326
154 Sorrento Valley Assoc 241
35 Southern Computer Sys Inc 64
325 Southwest Tech Prod Corp C II
210 Spectrum Software 271
3 SSM 11
166 The Stackworks 246
282 Starburst Computer Group Inc 316
130 Strategic Simulations 213
93 Structured Sys Group 154
31 SubLOGIC 60
73 Summagraphics 125
298 Sunflex 322
254 Sunny International 302
* Supersoft 92
78 Supersoft 135
94 Supersoft 155
206 Support Tech & Prod Inc 269
11 Symtec 25
60 Sybex 103
61 Synchro Sound 105
222 Synergetic Comp Prod 277
108 Tarbell 183
69 Tech Sys Consultants (TSC) 119
64 Tec-Mar 108
13 TeleVideo Inc 27
278 Terminal Data 316
57 Texas Electronics Instruments (T.E.I.) 98
26 Texas Instruments 47
157 3-G Co 243
23 3/M Company 42, 43
* Robert Tinney Graphics 17
317 TL Industries 328
297 Torrey Pines Business Sys 322
199 TransNet 265
* United Software 245
241 Univair Inc 294
36 Universal Data Sys 65
207 US Robotics 269
216 Vector Electronics 274
20 Verbatim Corp 37
302 Videx 322
324 Vista Computer 334
270 VR Data 309
251 Wameco 300
* Wang Labs 217
197 Western I/O 263
* Whitesmith's Ltd 127
313 Wintek Corp 328
281 Worldwide Electronics 316
181 Z_S Systems 253

BOMB

BYTE's Ongoing Monitor Box

Article #	Page	Article	Author
1	12	The Cassette Lives On, An Alternative to Floppy-Disk Mass Storage	Cook
2	20	A DC-to-DC Converter	Picco
3	22	I/O Expansion for the Radio Shack TRS-80, Part 1: Principles of Parallel Ports	Ciarcia
4	44	KIMDOS, Using Your KIM-1 with a Percom Floppy-Disk Drive	Swank
5	72	Interface a Floppy-Disk Drive to an 8080A-Based Computer	Hoeppner
6	104	A Graphics Text Editor for Music, Part 2: Algorithms	Nelson
7	120	Using the Computer as a Musician's Amanuensis, Part 2: Going from Keyboard to Printed Score	Raskin
8	130	Comparing Floppy-Disk Drives by Software Simulation	Nendza
9	196	Give Your Computer an Ear for Names	Munnecke
10	202	The Club Computer Network	Kasser
11	214	The COSMAC Doodler	Duntemann
12	250	Error Checking and Correcting for Your Computer	Walker

Bomb results on previous page

There are two sides to our story.

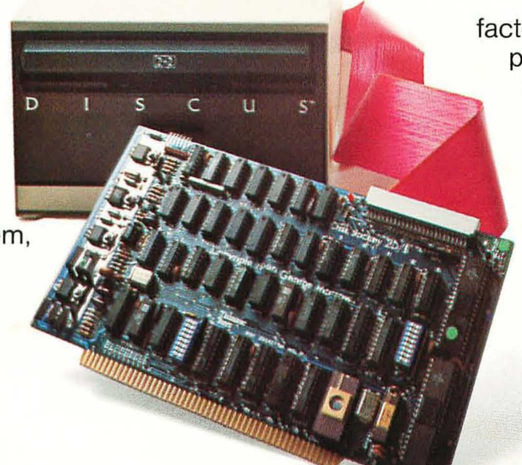
Side One

The DISCUS™ 2+2 Quad-Density Hardware

Now you can use your S-100 system to tackle big jobs. Because the DISCUS™ 2+2 Quad-Density Disk System puts 1.2 megabytes of fast-access memory on your side for just $1545.00 complete.

With the DISCUS™ 2+2 System, complete means complete.

You get a full-size (IBM-compatible 8") double-sided/double-density disk drive,



factory mounted in a cabinet with power supply, fully-buffered S-100 single-board controller, and interconnecting cables. All fully assembled, system-tested and fully warranteed.

You get the speed and efficiency of 1.2 megabyte-per-diskette memory... and you get it for 0.13¢ per byte.

Side Two

The DISCUS™ 2+2 Quad-Density Software

1.2 megabyte quad-density hardware is only one side of the story. The DISCUS™ 2+2 System price includes all the fully-interfaced, high-performance software you need to take full advantage of your quad capacity.

The system includes our exclusive BASIC-V™ virtual disk BASIC, which allows you to address your quad-density diskettes as easily as main memory. The operating system you get is the widely accepted CP/M* 2.1. And you get our powerful DISK-ATE text editor/assembler; The most advanced software



development tool available.

Micro-Soft BASIC 5.1 and Micro-Soft FORTRAN are available as options. Both run under CP/M* 2.1.

Check out the full system price of DISCUS™ 2+2 Quad against any other floppy disk system at your local computer store. At $1545.00, we think you'll take sides with DISCUS™ 2+2.

If your dealer doesn't carry THINKER TOYS products, write MORROW DESIGNS Inc., 5221 Central, Richmond, CA 94804. Or call (415)524-2101 9-5 weekdays (Pacific Time).

MORROW DESIGNS™/ Thinker Toys™

*CP/M is a trademark of Digital Research.

Circle 326 on inquiry card.

Step up to your next computer.

16 COLORS

CHALLENGER 4P

STEP UP TO A C4P FROM OHIO SCIENTIFIC

You know about computers. In fact, you probably own one now. One that you might be thinking of expanding. We have a better idea. Take a giant step into the personal computing future with an amazing, new C4P from Ohio Scientific.

SPEED SEPARATES THE COMPUTERS FROM THE TOYS

The C4P MF has execution speed that is twice as fast as Apple II or Commodore PET and over THREE times as fast as TRS-80. They are many times faster than the recently introduced flock of video game type computers. And, as if that weren't fast enough, the C4P nearly doubles its speed when equipped with the GT option.

Just look at the back panel of the C4P MF.



All the I/O you'll ever need!

Apple II, Commodore PET, TRS-80, and Atari 800 are registered trade names of Apple Computer Inc., Commodore Business Machines Ltd., Radio Shack, Atari, respectively.

SOUND

1—programmable tone generator 200 — 20KHz
1—8 bit companding digital to analog converter for music and voice output.

HUMAN INPUT EXPANSION

2—8 axis joystick interfaces
2—10 key pad interfaces

HOME INTERFACE

1—AC-12 AC remote control interface

DISPLAY

32 x 64 with upper and lower case
2048 Characters.
256 x 512 effective Graphic Points
16 Colors

SOFTWARE

Ohio Scientific offers a comprehensive library of both systems and applications software for the C4P.

> The C4P is an outstanding premium computer — years ahead of the market. We know because there's nothing quite like it for the price, anywhere. And probably won't be for a very long time.

Circle 327 on inquiry card.

C4P $750

8K BASIC-in-ROM, 8K of static RAM and audio cassette interface. Can be directly expanded to 32K static RAM and two mini-floppy disks.

C4P MF $1795

All the features of the C4P plus real time clock, home security system interface, modem interface, printer interface, 16 parallel lines and an accessory BUS. The C4P MF starts with 24K RAM and a single mini-floppy and can be directly expanded to 48K and two mini-floppies. Over 45 diskettes now available including games, personal, business, educational and home control applications programs as well as a real time operating system, word processor and a data base management system.

Computers come with keyboards and floppies where specified. Other equipment shown is optional.

For literature and the name of your local dealer, CALL 1-800-321-6850 TOLL FREE.

OHIO SCIENTIFIC
1333 SOUTH CHILLICOTHE ROAD
AURORA, OH 44202 • [216] 831-5600